School of Information Systems

Methodology Development for Measuring Virtual University Social Responsibility

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Declaration

Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis submitted for the award of any other degree or diploma.

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Thesis Summary

This thesis addresses the most challenging issues in online education and its social responsibility. The researcher has developed the world's first ontology on virtual university social responsibility (VUSR) and provided an ontological-driven approach for measuring the corporate social responsibility (CSR) for virtual universities (VUs) in five dimensions, namely education, research, engagement, ethics and transparency. The author also examines the impact on social, economic and ethical standards by rigorously defining measurement indicators and performance assessment attributes to help assess the CSR.

In the technology-enabled networked arena, much more attention has shifted to profit-making rather than social responsibility, including stakeholders' and societies' sustainable development. While social responsibility is a matter for all kinds of organisations, the higher education system and specifically online or virtual universities as organisations which it is assumed nurture people for a sustainable society, cannot stay out of the line. The researcher contributes to the VU literature by building the body of knowledge with a comprehensive formal definition of the concepts of VUSR. The study also presents a methodology for measuring the CSR of VUs. The most significant contribution made through this thesis is the development of the world's first ontology on VUSR, which describes all the VUSR concepts. The other significant contribution is the development of the ontology-based measurement framework for VUSR, including criteria dimensions, impacts, indicators and performance attributes. This is followed by another major contribution, which is the proposed Analytical Hierarchy Process based approach and fuzzy system based analytics techniques to measure the VUSR to obtain an overall figure of merit of CSR for a VU. In order to provide proof of the concept, a prototype system was developed and proposed for the VUSR ontology, the measurement framework and methodology, as well as the analytic techniques which were demonstrated step-by-step through the prototype of the open knowledge-sharing portal to allow the VUSR domain knowledge assimilation, dissemination, evolution, integration and application to any online or virtual university environment.

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List of Publications

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Chapter 1_ Introduction

1.1. Introduction

Increasing learners' demand for accessible and flexible education with lower costs, coupled with the advances in learning technologies derived from emerging digital infrastructure development for the higher education sector, have changed the learning environment considerably in recent decades. The results are modified academic programs and structures in the traditional universities, in forms of online courses or virtual universities (VUs). These recent forms of higher education institutions are cemented by digital networks with no physical classrooms or campuses, leading to cost reduction and meeting the need for anytime, anywhere, in real-time and just-in-time for higher education. However, besides their growth, these new education paradigms are facing societal challenges including quality of education and accountability, as well as the trustworthiness of the education providers. This thesis is to address these key issues by concept definition and methodology development for measuring the VUs' social responsibility.

Chapter 1 of this thesis gives an introduction to the emergence of the VU, its key challenges and research to date. Section 1.4 provides clarifications regarding the interchangeable terms that have been used for VUs to make the scope of its domain clear in the current study. It then introduces the preliminary concepts of social responsibility and its associated terms used in this thesis (section 1.5). This will be followed by discussion of the importance of the key concept of VU social responsibility in section 1.6. The significance of measuring VU quality and trustworthiness of the education providers will be discussed in section 1.7. Section 1.8 provides the objectives of the thesis, and the thesis scope is laid out in section 1.9. The significance of the research will be highlighted in section 1.10 and the following section (1.11) will present the plan of this thesis. The chapter will be concluded by section 1.12.

1.2. The Emergence and Challenges of the Virtual University

The growth of VUs is rooted in the increasing demand for higher education degrees. In the United States (US), South East Asian countries such as China, Korea and Japan, as well as Middle Eastern countries such as Iran, there is a huge demand for higher education not only from the young generation, but also from job-holders. This has resulted in the rapid development of public and private VUs. In order to meet the education needs of the under-served population, this mode of higher education around the world is receiving intense research attention from different perspectives (e.g. Danesh, Hashemnia, Sirousbakht & Kia, 2013; Fooladvand & Yarmohammadian, 2011; Masoumi & Lindstrom, 2012; Montazer & Bahreininejad, 2007).

Despite of their growth of supply and demand, VUs are subject to criticisms in regards to their quality, credibility and capability to meet the demands of their stakeholders, specifically students, faculties and employers.

Regarding the educational function of VUs, the quality of online education has appeared as one of the major challenges. In fact, providing high-quality education and accountability are what almost all virtual students expect (Twigg & Oblinger, 1997). However, VUs are facing more rigorous necessity for accountability nowadays (Vignare, 2009). Several key challenges have been raised around the VU and online education, including:

(1) whether the online universities can provide the quality of education that conventional universities do (Fooladvand & Yarmohammadian, 2011) or if they are inferior in quality to the conventional ones (Davis, Sauber & Edwards, 2011);

(2) the demand for online education gave rise to a huge number of poor-quality online education providers which are called fly-by-night institutions, diploma mills or other derogative names (Levy, 2011). The emergence of poor-quality online education providers threatens the legitimacy of online universities in a global landscape (Guri-

rosenblit, 2012) and may intensify the questioning of the quality of virtual education from the stakeholders' point of view;

(3) as highlighted by Bower and Hardy (2004), the VUs are facing lack of acceptance by society. Trust has been identified as one of the major acceptance factors in online universities (Chung & Ellis, 2003), however, scholars have revealed that the lack of trust from students and employers are the critical issue with these type of the higher education systems (Columbaro & Monaghan, 2009; Sarlak & Abolhasani, 2008). While these universities strive to survive and to be successful, they need to be accepted as a practical and effective instructional education method by their stakeholders including students, employees, employers, government and the general public;

(4) the VU education system has also been questioned in the literature regarding their ethical performance. Brey (2003) challenges VUs in terms of their capacity to fulfil the non-academic functions, as they initially have emerged to provide academic services. He argues that for this kind of university, it is difficult to accomplish functions such as cultural transmission of values, social integration, promoting change in personal and social levels, establishing social networks, and, finally, offering social services.

This study shows that the above-mentioned challenges facing VUs implicitly endorse the need for corporate social responsibility measures and attention to the approaches necessary for the evaluation of the quality of online education and the trustworthiness of virtual education providers.

In order to nurture the endurance and growth of online universities, these challenges need to be overcome through measurement of the university quality and standing regarding its social responsibility, and detection of areas that need to be improved. Taking these steps enables VUs to establish trust among the stakeholders and sustainability in the competitive networked world.

This thesis is to contribute to the VU literature of sustained quality and trustworthiness measures through building the body of knowledge with comprehensive

formal definitions of the concepts in the field of VUs' social responsibility. The study is also expected to contribute to the literature by proposing a methodology to measure the social responsibility of VUs and to enhance the knowledge concerning university social responsibility in the context of a rapidly evolving global online education society.

1.3. General Issues Regarding the Virtual University

The aspect of the VU to be covered by this thesis involves issues from different points of view. The academic literature contains many contributions in which online education in general and VUs in particular have been investigated from different perspectives, such as quality of education, acceptability of online degrees, accountability of VUs, online learners' perceptions and satisfaction, learning theories and paradigms in the virtual environment, etc. Many of these contributions implicitly or explicitly point out the social responsibility concerns in VUs. However, it seems impossible to find contributions that contain the concept of representation or definition for this context.

The aforementioned issue, i.e. lack of academic attempts to outline and define the VU's social responsibility and its domain, is the starting point for further issues. If VUs' managers are concerned about how to manage their accountability and how to improve their image and trustworthiness in the local and global society, they need to seek appropriate ways for evaluation and measurement of their social responsibility. These institutions require modified tools and techniques which enable them to measure this aspect of their existence. While the domain has not received significant research attention, so far the results are the measurement tools and approaches which focus on some of the components of social responsibility while disregarding other major components.

Another general issue to note in this section is associated with the techniques by which the VUs' contribution to accountability and social responsibility can be measured. VUs are required to be equipped with techniques that enable them to

measure their accountability from multiple perspectives considering a variety of dimensions.

Considering the issues, it can be inferred that VUs are required to address a fourth issue, which is considering the creation of a knowledge-sharing portal regarding their social responsibilities. In such a portal, all stakeholders can be engaged to create a more comprehensive understanding of the concept and its associated framework for measurement purposes. It also may facilitate the collaboration of experts in the field outside the university to exchange ideas.

As a result of the above-mentioned discussion, it can be inferred that this domain requires more research attention regarding the VU's accountability to formally represent the concept and clarify its domain, to define the measurement approach and to develop the appropriate tools and techniques for the concept measurement.

1.4. Interchangeable Concepts – Open/Virtual/Cyber/Online Education

The concepts of online education, open universities, VUs, distance education, cyber universities etc. are not exactly the same, as detailed in this section. However, as the thesis is intended to develop a social responsibility across online-based education or open or VUs under the specifications of the scientific program sponsored by the Iranian Minister of Education, I have decided to use the term 'virtual university' which may represent open universities or online-based education, to distinguish those physical universities that have classroom and face-to-face teaching.

1.5. Clarification of Interchangeable Concepts

VUs as the new form of higher education institutions need to be concerned with their contribution to improving the quality of life. Although VUs are similar to conventional universities in that their main mission is providing education for the under-served population, there are considerable differences between these higher education systems.

A variety of associated terms have been employed to refer to these new higher education institutions such as distance education, e-education, web-based education, open university, online university, VU and so forth. Although these terms are not the same, they have been used synonymously in the literature. In this section, to clarify the scope of the VU in the context of this research, these associated terms will be discussed and outlined.

1.5.1. Distance Education

Increasing learners' demand for accessible and flexible education with lower costs, which is concurrent with advances in learning technologies, drove the higher education sector to change learning environments considerably in recent decades. The results are modified programs and structures in traditional universities, as well as emerging new forms of higher education institutions in which everything is designed to facilitate meeting the above-mentioned conditions.

'Distance education' is the most renowned descriptor used in the literature to reference the process of teaching and learning for those who are geographically distant (Moore, Dickson-Deane & Galyen, 2011). It has primarily been established to meet the educational demands of people who are not able to take advantage of a full-time residential educational program. As Evans & Pauling (2010) mention, this kind of education has a strong connection to the communication technologies and its evolution occurred through advances in these technologies over the decades. The history of distance education goes back to the 1800s when imparting education by post was launched. In the early years it was referred to as *"correspondence education"* and it operated initially while students and instructors were in the different locations through correspondence programs. However, after the invention of audio-visual media, such as radio and television, and due to postal limitations, distance education programs shifted to use these new media as their delivery systems and its name changed to *"distance education"* (McIsaac & Gunawardena, 1996; Molenda, 2008).

Universities that impart education using this method were called "Correspondence Tradition Universities" (Hanna, 1998). These universities were mostly founded to improve accessibility of higher education through traditional

learning materials such as TV, radio, video and audiotapes. Hanna (1998) also refers to this kind of entity as "Distance Education National Universities" because they are mostly organised and operated by governments to serve public development. The British Open University (OU) is one of the well-known instances of this category which started in 1971 to offer distance learning for people who were not able to attend conventional universities ("History of the Open University," 2011). Separation of students and instructors as well as using one-way learning materials can be mentioned as the two main characteristics of distance education in this stage.

Correspondence Tradition Universities, as Hanna (1998) mentions, faced a number of barriers such as organisational weaknesses and the lack of interaction among students and instructors. To overcome these challenges, another kind of distance university was established where higher education was able to take advantage of improved communication technologies such as two-way video and audio systems and satellite technology to connect distance students to other students and instructors in a regular classroom. Hanna (1998) named these universities the Extended Classroom Tradition and the National Technological University (NTU) in the US as a famous example.

Digitalisation of information and communication technologies provided a huge advancement for distance education from the late 1980s (Evans & Pauling, 2010), by which distance educational programs were equipped with new media such as email, the web, teleconferencing and videoconferencing. More recent media furthered a new learning environment in which learners have the opportunity to communicate interactively with other students, instructors and learning materials. Nowadays, distance education can be performed through a variety of synchronous and asynchronous media such printed, audio-visuals and digital media, however the internet has (Bower & Hardy, 2004) provided a rich source of online applications such as discussion forums, chat sessions, wikis, networks, podcasts and more, by which learning anywhere, anytime can be achieved.

In order to clarify the scope of distance learning, it is worthwhile to identify the key factors and main characteristics of this kind of education. According to the literature, distance education constitutes of a number of key components including

learners, instructors, technology mediated delivery method, educational content and learning environment (Banerjee & Brinckerhoff, 2002; Evans & Pauling, 2010; King, Nugent, Eich, Mlinek & Russell, 2000). The main features by which distance education has been defined through this literature are time and place, because this kind of education emerged to eliminate the barriers of time and place and to develop a flexible educational environment for all people. Distance education defined by the United States Distance Learning Association (USDLA) as the

> ***acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance*** (Bower & Hardy, 2004, p. 5).

The above-mentioned review of distance education reveals that this term can be used as an umbrella term which covers a variety of educational systems from traditional techniques via printed material, TV and radio to modern techniques through online videoconferencing and so on.

1.5.2. Open University

The OU in the United Kingdom was established in 1971 to provide learning opportunities for working adults who had difficulties attending the conventional universities ("History of the Open University," 2011). The main characteristics which distinguish the OU from most of other universities, as mentioned by Rada (2001), are as follows: firstly, it is open to any adult irrespective of previous educational background and qualifications; and secondly, learning materials are delivered to the learners in their own places. The education delivery can be through the post, personal computers or national television broadcasts.

The OU can be considered the earliest operating model and example of VUs (X. Chen, 2010), however, in the literature, this name has been used to refer to more flexible higher education and sometimes synonymously with virtual university (Bijnens et al., 2008; Kukeneh, Shahbahrami, & Mahdavi, 2011; Mirzakhani, Ashrafzadeh, & Ashrafzadeh, 2010) or generally with distance education (Datta & Ottmann, 2001). Open University Australia (OUA) is another distance education

organisation owned by seven Australian public universities and committed to providing open access to higher education on a national scale (Deden, 2005).

1.5.3. Online/Web-based Education

Hanna (1998) in his seminal work on classification of organisational models of higher education institutions refers to online/web-based universities as the emerging models of higher education institutions. He defines the online university as a technology-based distance education system in which students using new asynchronous technologies have the opportunity to study together independent of distance, time, and place. Online universities benefitting from advancements in communication technologies contributed to improving not only the accessibility of higher education but also interactivities between and among the students (Hanna, 1998). There is not much attempt in the literature to define what an online university is. It seems that online or web-based universities are obvious enough not to be defined by scholars. Joo et al. (2011) simply defines online university as a higher education institution in which all teaching, learning and administrative activities are carried out online. It can be noted that obviously online or web-based university is an advanced form of distance education which takes advantage of the internet, web and its associated technologies.

1.5.4. Cyber University

Unlike distance education or open universities, which may have a physical campus while offering courses online, a cyber university refers to a VU that offers all its courses, degrees, assessment and awards online and it may not use a physical campus or a classroom for teaching and learning purposes, except for central administration. Since the dot.com boom period in 1996, public and private organisations in many countries around the world opened cyber universities, the champions are the US, Hong Kong, Japan, Korea and Thailand. Cyber universities provide low-cost solutions for both learners and education organisers. However, without a strong reputation, many cyber universities borrow academic experts from many traditional physical universities to provide the courses. Therefore, many cyber universities are powered by the physical universities (those that offer face-to-face physical education with

campuses and classrooms). The motivation for the traditional physical universities and their academics to offer some courses to cyber universities is the financial incentives to the university or academics.

1.5.5. Virtual University

'Virtual university' is an overarching or umbrella concept that covers all online, distance, open and cyber universities which offer entire courses and degrees through the internet in the digital economy. A VU is empowered by advanced internet technology and the demand for more knowledge and flexible learning, whereas traditional universities have inadequate capacity to keep pace with the demands of students who live in the digital age (Anastasiades, 2002). VUs have been developed to address the growing demand for distance education. A number of reasons behind this demand include accelerating knowledge development, adults' increasing desire for learning to be more and more up to date in their professional lives, and unprecedented advances in information and communication technologies (ICT). The need for lifelong education and training for adults, as Hanna (1998) argues, might be one of the main drivers for these new higher education institutions. The term 'VU' refers to one form of online learning which provides flexible access to higher education for students all around the world. Van Dusen refers to the Virtual Campus as:

> ***a metaphor for the teaching, learning and research environment created by the convergence of new powerful instruction and communication technologies*** (Van Dusen, 1997).

There are a variety of definitions for VU that mostly refer to it as a web-based learning environment for higher education in which there is no physical structure and which uses synchronous and asynchronous technologies to transfer content and provide learning opportunities to students (Ryan et al. 2000). The main purpose for establishing VU is to develop higher education access for people who cannot satisfy their educational needs in conventional universities. The Commonwealth of Learning define the VU as a higher education institution which is the result of partnerships and alliances for facilitating teaching/learning processes and provides learning opportunities to students through ICT. This university is also committed to provide

tuition support and extending educational access without itself being involved as a direct provider of education (Farrell, 2001).

In the literature, VU is also referred to as Agile University which is dedicated to providing individualised learning experiences for students and to overcoming the geographical barriers as well as socioeconomic disadvantages (Cunha & Putnik, 2007). Cunha and Putnik (2007), proposing the concept of Virtual/Agile University (V/AU), attempt to outline the framework of such a university. In their contribution, reconfigurability dynamics and permanent alignment with learner requirements are two main nessecities of V/AU. The strenghes of this type of university are custumisation, agility, fast response, and providing high-quality lifelong learning to meet students' needs (Cunha & Putnik, 2007).

Anderson (1999) defines VUs as a multimedia network learning environment which is empowered with customisable facilities and is different from traditional universities (Anderson, 1999). VU also is defined as a form of organised teaching and learning activities and processes in which electronic resources have been employed and occur mainly over the internet or a hybrid approach (Yengin, et al., 2010). As scholars point out, the major aspect of the VU is the dispersion of university teachers and students in different geographies (Shekhar, 2006). Research findings show VUs could overcome time and place barriers of study (Anderson, 1999; Barbour & Reeves, 2009; Johnston, 2007; Tabatabaie, 2010). This means students can be educated wherever and whenever suits them. Although VUs are proceeding in various sizes and organisational models, they encounter challenging requirements for their responsibility and reporting (Vignare, 2009). Accountability and the quality of education are what almost VU students expect (Twigg & Oblinger, 1997), and this might be the reason for most students preferring to enrol in conventional universities.

Meyer (2009) tries to set forth a new definition for VUs, however, he refers to a variety of VU models and taxonomies which scholars have suggested. According to his work, one of the classifications for VUs is putting them into two categories of centralised versus decentralised. In the decentralised model in contrast to the centralised, there is no central body and different institutions provide their own services for stakeholders. The past decade witnessed huge advances in communication

technologies, especially the emergence of Web 0.2 technologies which led to more interactive and collaborative techniques in VUs. Scholars referred to the new form as VU 2.0 where a variety of Web 2.0 technologies were involved in the process of teaching and learning (Ivanova, Ivanova, & Smrikarov, 2009). In this form of VU students are not just the consumer, they are active users who create the learning content. There are more views on VU definitions, however, those mentioned here are the most appropriate for this research project. To conclude, it can be noted that although definitions of a VU might be phrased differently, a general agreement can be seen in that a VU is a higher education institution committed to providing individualised learning opportunities at anytime, anywhere and for everyone. In such a university, the educational programs can be tailored to individual learners' needs, and therefore the achievement of anticipated learning outcomes can occur more quickly for each student.

1.5.6. Relationships between Existing Terminologies of the Virtual University

Once the essence of the terms associated with VU has been explained, it is necessary to outline the relationships among these concepts. The term 'virtual' is overarching, covering a wide array of concepts such as online, open and distance, distributed, networked, technology-based, internet-based, web-based, and is sometimes used interchangeably with the above words and is usually followed by a pedagogical concept, i.e. education, instruction, learning, and so on. Anohina (2005) in her study, analyses all these terms and refers to the word 'virtual' as an umbrella term for all other terms. She postulates that it stands for something "different, peculiar", therefore virtual learning represents a learning process which is different from the traditional learning processes. In the same way, VU indicates a higher education institution which differs from conventional universities and is characterised by technology-based learning techniques, and learner-based approaches. Farrell (2001), however, prefers to use 'open' and 'distance' as the umbrella terms which can embrace any or all of the other concepts and practices of open, flexible, distance, online, and virtual education /learning.

Considering the above-mentioned concepts and their definitions, it can be noted that the common feature among distance education, online university, web-

based university, and VU is dissolving the geographic barriers for higher education users. In all these learning systems, instructors and learners as well as the administrative body can be located in different parts of the world and they don't have face-to-face communication. The differences among these systems are allied in the communication tools and techniques they employ. It can be conferred that 'distance education' has the broadest scope because the instructional tools and communication technology in this type of education are not limited to electronic tools, or online technologies. As mentioned before, distance education in its evolution took advantage of a variety of tools from postal and written materials to audio-visual tools (such as TV, radio, DVD), and these days internet and other online tools. So the term 'distance education' can be considered the umbrella term (see Figure1.1).

Figure 1-1 The existing terminology for virtual university

The vision of any form of online/virtual university is to: re-examine the physical restrictions of the education; facilitate more teamwork; develop the continuous time-independent learning; and support multilevel, multispeed learning experiences through the employment of information technologies.

The definitions presented in the previous sections point out that although the discussed terms are phrased differently, all refer to the same type of higher education system in which A3, i.e. anytime, anywhere and anybody (Ebner, 2007), is the fundamental assumption and characteristic. The scope of this research is considering social responsibility in the online/virtual universities disregarding other types of

distance education systems. For more clarification of the scope of the VU in this research, its characteristics are outlined in the following section.

1.6. Preliminary Knowledge on Social Responsibilities

The primary concept in this thesis is social responsibility, which has a rich background. The concept has been discussed as containing both individual and, more frequently, corporate responsibilities. Peric (2012) believes that to nurture social responsibility, individual needs to be considered as the starting point. In its literature, different terms have been joined to the notion of social responsibility and a variety of definitions and understandings have been generated for this concept. Due to the importance of this notion in the current study, this section aims to provide an overview of the concept in general and specific contexts. These concepts will be defined formally in Chapter 2.

1.6.1. Corporate Social Responsibility

The concept of social responsibility has its origins in the corporate world and in the academic literature has been known mostly as the corporate social responsibility (CSR). In this sense, the term 'CSR' broadly refers to the corporate actions that benefit society more than providing profits for the corporation. A socially responsible corporate is expected to take care of its employees, suppliers, final users of its product, and all other stakeholders, because its success depends on factors beyond the business aspects (Peric, 2012). The concept generally points to the ethical and social aspects of the corporate behaviour, however, in many cases it has been used to refer to the economic and environmental dimensions as well (Dahlsrud, 2006). The social responsibility of a corporation highly depends on the how its stakeholders (e.g. employees, consumers, citizens, society) perceive the company's social behaviours (Calabrese, Costa, Menichini, & Rosati, 2012). Therefore considering the stakeholders' need and commitment to meet their demands is an inevitable aspect of social responsibility.

1.6.2. University Social Responsibility

The concept of university social responsibility (USR) highlights the significant role of higher education institutions regarding sustainable development (SD). In many cases, USR has been defined in the same way as CSR because it has assumed to be outlining CSR in the higher education context. In this research, although CSR will be considered as the basic notion for USR, the researcher intends to be more specific and focus on the characteristics of the social responsibility that are involved with teaching, learning and other functions of university as an educational system not as a corporation. In fact, universities through their functions (teaching, research, service) directly impact the society and the quality of life. A socially responsible university is expected to not only behave in a responsible manner, but also to foster the social responsibility of its students and staff. It is expected to contribute to society's development through not only services and projects, but also through nurturing high-quality graduates who are responsible citizens. In this aspect, one of the important functions of universities has been highlighted as providing academic service-learning programs (Marshall, 2010; Peric, 2012). These kind of educational programs can be considered an important aspect of university responsibility to both its students and community. The academic service-learning program enables learners to connect their learning to real-world practices and to strengthen the university and community connections.

As Grigore, Stancu, and Zaharia (2013) discuss, it is not easy to differentiate the university mission from its social responsibility, because the social responsibility of the university embodies the university functions and missions. Similar to CSR, the USR has in some cases also been considered to cover ecological aspect (Arnzten, 2009). In this thesis, however, the researcher differentiates social responsibility of ecological responsibility and concentrates on the university responsibilities to its primary and secondary stakeholders, including students, staff, families, citizens, employers, partners and other educational institutions.

1.6.3. Virtual University Social Responsibility

The above regarding USR can be applicable for virtual university social responsibility (VUSR), however with some considerations. As mentioned, online universities are

constructed on electronic networks and they do not include physical campuses. Therefore, those social responsibility aspects that are involved with the physical attendance of students and staff at the university cannot be considered while developing the VUSR framework. Considering social responsibility of higher education institutions as simply going beyond legislation and regulations (Sanchez-Hernandez & Gallardo-Vazquez, 2013), it can be said that VUSR is all about online universities' commitment to benefit their students, staff, and society beyond their obligations. It can appear in the form of VUs' contributions to improve the quality of online teaching, learning and resources beyond just delivering education, or informing their community about the level of their service and assure the quality of their programs. In addition, the notion of VUSR can include the university commitment to update and develop online staff skills and knowledge. As a result of the changing nature of online technologies and the required capabilities to deal with the online learners as the digital natives, providing professional development training for current and future online instructors has been emphasised by many scholars (Betts, 2009; Blair, 2011). The universities' commitment to this aspect of social responsibility can be a step forward to fostering the quality of online learning as the main responsibility of virtual education providers.

1.7. The Importance of Virtual University Social Responsibility

In the technologically developed world with more focus on profits, paying attention to social responsibility of entities and the benefits they bring to their societies is a must for achieving SD and surviving in the competitive world. In this arena, while the social responsibility is a matter of importance for all kinds of organisations, higher education systems, and specifically online universities as the entities who assume to nurture people for a sustainable society, cannot stay out of the frame (J. L. Vazquez, Lanero, & Garcia, 2013). In this scenario, due to the significant role of online universities in the education of professionals, managers and citizens, these institutions are required to implement and foster the notion of social responsibility. Byrne (2000), describing the characteristics of the University of Tomorrow, in fact highlights social responsibilities of the universities such as providing equal access to education for the under-served population, providing a genuine and student-oriented learning

community in which all sorts of resources and facilities help prepare for a better and more successful learning experience. It can be concluded from his point of view that the University of Tomorrow should be a socially responsible university.

Online universities like conventional ones should serve the society with responsible policies and strategies in an open and transparent atmosphere which assures high-quality education not only for the virtual students, but also for their prospective employers. In the globalised era in which information travels fast, all different entities are expected to behave ethically (Grigore et al., 2013) and online universities are no exception in this trend. Contributing to VUSR not only benefits stakeholders, but also assists online universities in improving their image, strengthening their trademarks and enhancing their institutional and ethical values in the community (Navarrete, Rojas, & Pantoja, 2012).

Besides providing equal access to a high-quality education, online universities also are required to consider how to educate a new generation to foster their morals and values. Since, there is evidence in modern society of a lack of morality, it demands a generation to endeavour to further their personal growth and contribute to society's development; to respect values; and to contribute to the community's improvement through their knowledge and skills (Peric, 2012). Therefore, while facilitating lifelong learning online universities should as a priority nurture active and responsible citizens.

While all the above pose significant threats, the online universities' social responsibility is one of the most important aspects, however, it still remains unexplored and needs more research attention in order to be defined. Defining and outlining of the VUSR concept in its totality enables the VUs to take the required steps to position their status and to develop strategies to improve their status in this setting.

1.8. The Importance of Measuring Virtual University Social Responsibility

The growth in the establishment of VUs needs to be accompanied by research to investigate these educational organisations from different perspectives. It is a must for all the higher education institutions to evaluate their functions in order to keep abreast of their stakeholders' needs and the rapidly changing society (Byrne, 2000). In other words, if online universities are willing to manage the process of their change and development, they initially need to contribute to measuring their functions and standing from different perspectives. The university commitment to social responsibility is one of the important perspectives that needs university managers' attention.

It is frequently mentioned that "you can manage, what you can measure" (Wheatley & Kellner-Rogers, 1999). In other words, entities strive to quantify their performance, activities, etc., to translate these actions into numbers and consequently to better qualify their interactions and communications. The measurement is defined by Frigerio, Giordani, and Mari (2009) as:

> ***a fundamental process aimed at acquiring and codifying information about an entity*** (p. 124).

Furthermore, it is the online students' and public's right to be informed how different online universities are performing and specifically what the standing of each university is in the social responsibility arena. So, it is crucial for online universities to engage in the social responsibility debate and to assess their impact on the society and the wider benefit they generate. The public needs to be clearly informed about online universities' contribution; therefore, they will be able to choose a more responsible VU for further education.

Contribution to VUSR measurement can assist a given VU to determine its overall social responsibility score and be able to identify the area(s) of poor performance which need to be addressed. Based on this information, the university may develop strategies to improve its social responsibility score. Also, the

implementation of such a measurement mechanism in virtual education systems can provide a reliable criterion for comparing universities with their peers and ranking them according to their commitment to social responsibility.

All the above-mentioned discussion as well as the previous section's debate led the researcher to the conclusion that more research is required to shed light on the subject of online USR. Hence, the researcher decided to contribute to the online university literature by analysing the existing body of knowledge to develop a general and comprehensive understanding of the VUSR concept. The generated knowledge will be used to develop the measurement framework and its corresponding methods to enable online universities to quantify their social responsibility. Developing a comprehensive VUSR metrics does not of itself deliver better outcomes, however if online universities do not have a measure for evaluation of their commitment to social responsibility, they may find themselves unable to persuade their stakeholders that they are as accountable as they believe and declare.

1.9. Objectives of the Thesis

The previous sections have outlined the importance of the concept of social responsibility in the VU context and the reasons online universities need to assess their quality standing regarding the notion of VUSR. This thesis is to develop and provide a measurement methodology by which online universities can be identified and quantified for their quality standing through mapping the level of their commitment to the social responsibility measures. The thesis also provides a measurement framework and techniques to examine the quality of a VU and to bridge the literature gaps in the field of CSR. The following objectives will be explored in this thesis:

1. To develop, extract and define the body of knowledge of CSR in the context of universities.

2. To develop the formal representation for the domain of USR and define its key dimensions.

3. To develop the formal representation for the domain of a VU through specialisation of the representation of USR knowledge for a VU, that is the specialisation of the USR in the online education setting.

4. To develop a measurement framework and methodology for the USR and VUSR incorporating a comprehensive set of measurements.

5. To develop the computational techniques that aggregate the measures from the measurement framework and methodology to drive an overall figure of merit of the CSR for a VU to address the complexity of human judgment in the process of VUSR measurement through implication of fuzzy and other possible techniques.

6. To develop a prototype of a VUSR knowledge-sharing portal which allows the online universities or stakeholders to learn and share the knowledge of USR and allows evaluation of their VUSR value along different dimensions and to obtain an overall score for justification of their quality education and the trustworthiness of VU providers.

1.10. Scope of the Thesis

The study focuses on developing a methodology for measuring the social responsibility of VUs. The body of literature is to be evaluated and analysed through the comprehensive study of the cumulative scholarly works in all the related areas to abstract the key concept of CSR with the intention of making a unique contribution to the definitions, benchmarking and measurement of social responsibilities of universities and making a clear distinction between a variety of terms. The proposed measurement framework in this thesis is targeting the online universities which operate entirely online, therefore the social responsibility dimensions involved with the physical structure and processes of universities will not be included in this thesis.

It is important to note that this thesis is not aiming to provide a tool to measure any online university commitment to the VUSR in real world, or collect data from the VUs. It is, however, providing a clear and concise body of knowledge, including concepts, measurement dimensions and techniques, criteria and indicators for the virtual university corporate social responsibility. The output of the thesis can be used in any measurement tool which enables VU managers and the general public to quantify the quality of education through the mapping of the level of the university's commitment to the defined CSR. The output of this thesis, subject to empirical testing, is a recommendation tool which helps a comprehensive understanding and measuring of the online universities' social responsibility.

1.11. Significance of the Thesis

To the best of my knowledge, thesis is aiming to develop a body of knowledge and measurement approach that is not available elsewhere. The significant contributions are the development of the world first ontology of the body of knowledge for CSR, university corporate social responsibility (UCSR) and VUSR. There is no knowledge resource or information pool, as well as approach, to measure the CSR, UCSR or VUSR available to date. The thesis gives substantial concept definitions, dimensions, measurement framework, metrics and indicators of VUSR. This study firstly defines the VUSR concept and then employs its dimensions to propose a comprehensive measurement methodology.

1.12. Plan of the Thesis

As mentioned earlier, this thesis is aimed to develop a comprehensive ontology and VUSR measurement methodology for quantification of the quality of education in VUs and its contribution to social responsibility. In order to achieve this objective, the thesis is structured in 15 chapters which will be outlined briefly in this section.

Chapters 2 will provide definitions and a review of the related literature to CSR in the VU setting, to represent the existing body of knowledge for addressing research issues 1 and 2. This chapter will review the concept of social responsibility in the general context, in the online education context and its measurement approaches. This review will cover the existing measurement approaches for social responsibility in the general context as well as the higher education setting. The researcher will also provide a critical review at the end of each methodological review to highlight the shortcomings of the literature.

In order to outline and define the research problem, Chapter 3 is planned to firstly provide the definitions of the key concepts associated with the problem definition and the entire thesis. Then, the formal definition of the research problems will be presented. The researcher will break down the research problem into a number of research issues that this study aims to address. These issues will be formally defined, and the research methodology and approach will be outlined.

Chapter 4 will define the conceptual framework of the thesis proposal and will present the solution overview for the highlighted research issues. In this chapter, the proposal of the overall solution and the overview of sub-solutions for each research issue will be addressed. The chapter also will provide detailed information on the approach of the study and how it relates to the rest of the thesis.

Chapters 5-6 will provide the ontological definition of the USR and its associated concepts. In order to address the research issue 1, chapter 5 will present the overview of the ontological driven solution and Chapter 6 will outline the USR ontology as well as sub-ontologies.

Chapter 7 will present the ontological representation of the VUSR concept to address research issue 2. The chapter also will provide the definitions of VUSR components through analysing the scholarly published works.

Chapters 8-9 will present the framework and methodology for the measurement of VUSR through the ontological approach. In order to address research issue 3, these chapters will present the measurement criteria dimensions, and the evaluation of each

of these criteria dimensions along with three other dimensions, including social, economic and ethical standard dimensions, and defines the indicators and assessment criteria for each measurement criterion.

Chapters 10 will consider the AHP technique for measuring the concept of VUSR. This chapter outlines a relative measurement model for VUSR evaluation to address the research issue 4. The proposed model will use a case study for more identification.

Chapter 11 will present computational techniques which help to capture, aggregate, compute and analyse the CSR for any VUs. This chapter addressing the research issue 5 will outline the fuzzy logic based techniques for measurement of the VUSR concept.

Chapters 12-14 will present the validation and verification of the proposed solutions in this thesis. Chapter 12 will define the detailed solution and verification of ontology development approach. Chapter 13 will outline the design and implementation of the knowledge sharing portal for the VUSR concept. Finally, chapter 14 will present the prototype system development for the proof of the concepts by outlining the knowledge-sharing portal for the VUSR and VUSR measurement. These three chapters are planned to address research issue 6 of this thesis.

Chapter 15 concludes the thesis by summarising the developed VUSR measurement methodology and the contribution made by the researcher. At the end of this chapter, the researcher provides insights into potential and future works.

1.13. Conclusion

The emergence of online universities at a rapid pace raise some challenges and criticisms around this new form of higher education, specifically regarding the university's acceptance by the society and its capability to meet the needs of the online students, staff and employers. Therefore, there is a high demand to investigate these

educational institutions in regards to their performance and their contributions to modern society. This thesis aims to contribute in this regard and to develop a measurement methodology for assessing VUs' commitment to social responsibility.

This chapter attempted to provide an overview of the research, therefore it firstly represented the initial definition of the concept of social responsibility in general and in university settings. The importance of the online university's social responsibility as the main concept of this thesis and its measurement as the main objective of this study has been outlined. This chapter also presented the objectives that this study aimed to attain as well as the scope and the plan of thesis to achieve the identified objectives. The next chapter of thesis provides a thorough review of the literature regarding the social responsibility definition specifically in a university setting and online education context as well as its measurement approaches.

Chapter 2_ Literature Review

2.1. Introduction

In the literature review, 168 documents have been studied and critically reviewed to find how CSR is defined and used in the context of higher education with the terms ‘university social responsibility’; ‘social responsibility of university’; ‘measuring university social responsibility’; ‘university community engagement’; ‘university public engagement’; ‘evaluating university community engagement’, ‘community university partnership’; ‘civic engagement’; ‘evaluating public engagement’; ‘scholarship of engagement’; and ‘evaluation of scholarship of engagement’. The researcher has summarised about 40 different types of definitions on CSRs/USRs and approximately 20 types of approaches for measuring CSR/USR.

In this chapter, the researcher will examine the literature on concept, knowledge representation and the principle aspects of social responsibility in VUs. The literature will also be reviewed to find existing approaches and methods for CSR/USR/VUSR measurement. In order to carry out comparisons and highlighting the literature gaps and issues related to measuring CSR in a VU, a critical review of the literature will be provided. Finally, conclusions will be presented at the end of the chapter.

2.2. Concepts and Definitions Related to Social Responsibility

There are a large number of scholarly works which evidence that social responsibility is receiving increasing research attention from academics and practitioners in different domains. The movement of paying attention to the social responsibility of organisations emerged in the business field and then proceeded to the other domains. This movement includes the higher education field and during the last decade a considerable number of research projects have been published regarding universities' responsibilities to society. According to the literature, some aspects of USR have already been regulated (Ramirez, 2012), however, other aspects are still neglected.

In this section, the concept of social responsibility and existing approaches to its identification will be discussed. In this regard, firstly the most commonly used definitions of CSR in a general context will be presented, then three main terms describing universities' responsibilities to their community and society will be defined. As the main purpose of this study is to develop metrics for evaluating CSR in a VU, it is essential to review what a VU is and the existing contributions for identifying its social responsibilities. Therefore, in the following section VU definitions and a VU's social responsibilities will be reviewed. In the next section, literature measuring social responsibility (CSR/USR) will be studied.

2.2.1. Corporate Social Responsibility (CSR) Concept in the Literature

With the continuing need to restructure learning environments to adapt to an increasing demand for higher education, as well as the growing advancements in instructional technologies, comprehensive evaluation of new higher education institutions from different perspectives should be the primary concern of emerging universities, i.e. virtual/online universities. The USR is one of the important aspects of online university performance which is not mature yet and needs more research attention. The USR has its roots in the corporate world where it has been called CSR.

The concept of CSR has emerged as a popular issue in recent decades. Numerous scholars have attempted to address CSR and to provide a clear definition of it in the

domains of business, industry, etc.; and in different geographies such as Europe, Asia, Africa, and so on. Although CSR appears to be a new concept, a review of the literature discloses that the concept has evolved over several decades. Its terminology has changed during the period as well. Some of the terms used to represent CSR are corporate citizenship, corporate social investment (CSI), corporate social performance (CSP), responsible business, the triple bottom line, and so on. In fact, CSR refers to how enterprises link their activities and policies to ethical and legal aspects, and how they consider their stakeholders' benefits. In different situations stakeholders constitute shareholders, employees, customers, communities, government, society and the environment. It should be mentioned that nowadays, the concept has been positioned as a new model and intends to promote sustainable development (Munoz, Fornos, & Morel, 2010).

As the literature reveals, CSR issues has been launched into the business context, and academics and practitioners have strived to deliberate over the concept and develop a variety of definitions and models for it. CSR has gradually gained scholars' attention in other sectors such as the media, sport, the mining industry, and so forth. Although there are considerable practical and theoretical approaches for measuring this concept in business, there is no methodology or framework for evaluating CSR in a VU, or even in higher education. However, a few efforts have been made recently to develop a framework and definition of CSR in the educational context. In the higher education context scholars have used other terms to refer to the CSR of a university. For example, USR is used to define the same notion and in this research project this term is used to refer to the CSR of universities. In American higher education 'scholarship of engagement' and in the United Kingdom (UK) 'university community engagement' are also used in the literature.

A variety of definitions have been developed to interpret CSR. Furthermore, as mentioned in the introduction, various terms have been used to refer to this concept in the literature. In the primary writings on CSR, the concept was cited more often as social responsibility (SR) than as CSR. Carroll (1999) believes that this is likely to be the result of the times, because the modern corporation's priority and primacy in the business sector had not yet happened or been marked. CSP is another term used interchangeably to represent this concept. Some writers believe that CSP differs from

CSR and argue that it can be interpreted as the outcomes of CSR actions (De Bakker, Groenewegen & Den Hond, 2005; Frederick, 1994; Igalens & Gond, 2005). However, others explicitly or implicitly refer to these terms as meaning the same (C. M. Chen & Delmas, 2010; Turker, 2009). A number of scholars have discussed the evolution of CSR's definition in the literature, such as Carroll (1999); De Bakker et al. (2005); Thomas & Nowak (2006); Dahlsrud (2006); and Cochran (2007). The purpose of this section is not to review all these definitions, but to convey the most prominent and common definitions.

It is argued that Bowen's book on CSR is a milestone in the emergence of the modern period on CSR literature. Carroll (1999) calls Howard Bowen the "Father of Corporate Social Responsibility" because of his early and seminal work. Heald (1970) also argues that Bowen's definition is mostly used for CSR. Bowen (1953) believed that social responsibility was not a panacea, but an important source of truth that must control business in the future. His CSR approach broadly constitutes corporate citizenship, the social adult, responsiveness, rudimentary stakeholders and stewardship theory (Windsor in Thomas and Nowak 2006).

A review of the literature reveals that, in the 1960s, the concept experienced a remarkable growth in scholarly works in contrast to the last decade (2000-2010). Davis (1967) and Fredrick (1960, 1994) are the most well-known writers in this period who tried to formalise the CSR concept. For example, Fredrick suggests that:

> ***Social responsibility in the final analysis implies a public posture toward society's economic and human resources and a willingness to see that those resources are used for broad social ends and not simply for the narrowly circumscribed interests of private persons and firms*** (Frederick, 1960, p. 60).

McGuire (1963, cited in Carroll 1999) also points out that social responsibility assumes that the corporation, besides its economic and legal obligations, has certain responsibilities to society. As Carroll (1999) mentions, Walton in his definition of SR emphasised the relationships between corporations and society and believed SR comprises a degree of voluntarism. Steiner (1971) defines SR as a philosophy with its subject being social interest and the elucidated self-interest of business over the long run. The literature reveals that Carroll is one of the main contributors to CSR's

definition as his seminal works in (1979 and 1999) have been broadly cited in CSR academic writings. He offers a four-dimensional definition for CSR:

> ***The social responsibility of business encompasses the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time*** (Carroll 1979, p. 500).

A more recent contribution comes from the World Business Council for Sustainable Development:

> ***Corporate social responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large*** (EBCSD in Moir, 2001, p. 18).

The Commission of European Community in 2001 said:

> ***Corporate Social Responsibility is a concept whereby companies decide voluntarily to contribute to a better society and a cleaner environment*** (Dahlsrud, 2006, p. 7).

A similar understanding of CSR can be found in Hopkins (2003) where CSR means the enterprise should behave ethically with stakeholders who are inside or outside the entity. As he highlights, in its broadest sense, CSR represents the higher standards of living socially and economically. It can be understood that all scholars define CSR more or less in the same way, that is, the ethical and economic responsibilities and accountabilities of the corporation for all its stakeholders, which comprise employees, customers, shareholders, investors, governments and communities.

Reviewing the CSR literature reveals that, while academics and business practitioners discuss this concept, they usually refer to similar components. The significance of investigating these components is especially important due to their critical roles in measuring CSR. Carroll (1991) in his influential pyramid of CSR, defines four main components of CSR, economic, legal, ethical and philanthropic responsibilities. However, some critics argue that CSR does not encompass legal obligations, because volunteerism is the main part of the socially responsible activities of the enterprises. As an example, the results of Dahlsrud's (2008) study support this idea. He analysed 37 various definitions of CSR from different sources during the

period 1980-2003, and eventually he outlined five dimensions of CSR in business settings as being environmental, social, economic, stakeholder and Volunteerism. This study reveals that during this period the five dimensions are used consistently to define CSR.

Another component of CSR, which raises some arguments in the literature, is the environment factor. Although most scholars consider the environment a component of CSSR, some authors argue that it is a distinct type of social responsibility and refer to this dimension as ecological not social responsibility (Muresan, Potincu & Duguleana, 2009); therefore, they exclude this dimension of CSR (Dzansi & Pretorius, 2009).

2.2.2. Social Responsibility and the Higher Education Context

In the higher education context, CSR as described in business settings is a relatively new concept and has been referred to as USR. However, the principles of this concept are not new and universities have long worked to benefit society through different functions. Since the 1980s, university responsibilities to its communities have been emphasised using university community engagement or university civic engagement (UCE) (ACU, 2001). The higher education literature shows that scholarship of engagement (SOE) is another term scholars use to define university responsibilities to society (Boyer, 1996). SOE emphasises that universities' mission is something beyond producing and transferring knowledge to new generations. Universities are asked to consider benefits to society instead of just profits.

Universities have the potential to serve society for sustainable development and favour the public good beyond their academic mission through what we call USR. These educational entities could embrace social responsibility in dealing with global challenges by their contribution in a variety of fields such as preparing scientific and technical expertise, promoting the sharing of knowledge, ideas and solutions, acting as a catalyst in multi-actor initiatives and considering all potential stakeholders (Harayama & Carraz 2012, pp. 121-128). In this section of the literature, to present the existing definitions of the USR concept, three main terms including SOE, UCE, and USR, will be defined.

2.2.3. The Scholarship of Engagement/Engaged (Public) Scholarship

The term SOE emerged in the American higher education context and was coined by Boyer (1996). He defines the concept in four essential functions for higher education institutions: discovering knowledge, integrating knowledge, sharing knowledge and linking knowledge to real practices. In his seminal contribution, Boyer argued that universities should broaden the scope of their scholarship into their communities and collaborate to meet their needs and address social and economic issues in their neighbourhoods. The concept is discussed through the literature as a kind of sharing of activities and benefits with the larger society:

> ***Scholarship does not reach its ultimate value until it is shared with the sponsoring public*** (Simpson, 2000, p. 12).

Through the evolution of this concept, scholars firstly differentiated SOE from the third mission of higher education which is service/outreach and defined it as a bidirectional partnership between university and its community (Sandmann, 2008). In this sense, scholarly engaged universities are expected to extend their service mission to embrace engagement in a reciprocal and bidirectional interaction with their society instead of one-direction assistance.

Another approach to defining SOE, uncouples the engagement of service and outreach. As Sandmann (2008) highlights, from 2000 to date most scholars have defined the concept of SOE through other university missions, i.e. teaching and research instead of public service. In this new sense of SOE, a scholarly engaged university is anticipated to engage with its communities through applied research, participatory action research (PAR), community-based research and service-learning as a beneficial instructional pedagogy. Sandmann (2008) analysing the literature of SOE in higher education derives two grounding principles of SOE as:

> ***(1) mutually beneficial, reciprocal partnerships and (2) integration of teaching, research, and service*** (p. 96).

The concept of SOE has been used interchangeably with other terms such as community engagement, community development, public service, outreach and PAR.

Engaged scholarship is also used synonymously for SOE which is defined by Holland (2005) as those kinds of academic activities, i.e. teaching and research, which connect the academic world to external communities in a beneficial manner for both parties. In this contribution, engaged scholarship is assumed an equivalent word to 'engagement', which is an increasingly influential factor on higher education policies and procedures, scholarly reputation and institutional diversity.

Similarly, Franz (2009) in his attempt to develop a holistic model of SOE, uses the 'engaged scholarship' term and defines it as a reciprocal relationship between academia and community which adds value to both parties (i.e. academic discipline and community). She defines six functions for engaged scholars encompassing discovery of new knowledge, developing the knowledge, disseminating the knowledge, change in learning, change in behaviour and, finally, change in conditions. As Franz argues, engagement between academia and community can occur at any or all of these functions.

According to the literature, community-based participatory research and service-learning pedagogy are the most referenced strategies by which a scholarly engaged university contributes to knowledge production in such a manner that reduces the society's issues and improves the quality of life of its communities (Bringle, Games, & Malloy, 1999). Due to its importance, a number of scholars in the higher education field have contributed to definitions of these two crucial strategies. One of the highly referenced definitions for service-learning as an instructional pedagogy comes from Jacoby (1996) who defines the concept as:

> ***A form of experiential education in which students engage in activities that address human and community needs together with structured opportunities intentionally designed to promote student learning and development. Reflection and reciprocity are key concepts of service-learning*** (p. 5).

Community-based participatory research, which is another crucial strategy of SOE, is also referred as PAR, or even action research. The concept is well defined by Reason and Bradbury (2001) as:

> ***The participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes (p. 1).***

Byrne (2000), discussing characteristics of the future universities, refers to engagement as a defining characteristic for these entities. The consequences of the SOE movement started by Ernest Boyer (1990a) was shifting from rigid academic terms of teaching, research and service to learning, discovery and engagement for the American higher education system (Holland, 2005).

The taxonomy of SOE practices as outlined by Barker (2004) comprises five different forms of engaged scholarship: public scholarship, public information networks, participatory research, community partnership and civic literacy scholarship. Underlying each of these practices is a specific conception of democracy and it encompasses its own methodology to address a particular set of community issues. Although the SOE practices of Barker's taxonomy are different, they all overlap and all aim to broaden scholarly engagement to facilitate the achievement of higher education responsibilities to society.

Public scholarship is also synonymous for SOE in the literature. Janke and Colbeck (2008), highlighting two main strategies of public scholarship, i.e. service-learning and PAR, define the concept:

> ***Public scholarship is an emergent philosophy of education which suggests that higher education institutions have a civic responsibility to engage in knowledge creation and problem solving that are relevant and helpful to the public*** (p. 31).

As the literature shows, scholars refer to a variety of terms, such as engagement, scholarship of engagement, engaged scholarship or public scholarship, trying to identify some higher education responsibilities to society to meet the increasing demands of all stakeholders. One of the well-known organisations in this field is the Kellogg Commission on the Future of State and Land-Grant Universities, which was established in 1996 by the Association of Public and Land-grant Universities in the US. In the last published report of the commission, some principles and guidelines for academic reform in our changing society are featured, including defining the university as a learning community, providing access and educational opportunities for the widest possible population, educating students with required skills, attitudes and values for a successful future, maintaining and improving the quality of education while reducing the costs (accountability), developing distance learning techniques to meet emerging

needs, flexibility and responsiveness (Kellogg Commission, 2001, p. 5). The Kellogg Commission movement, specifically in American higher education, has a significant effect on the SOE literature and it should be noted that some scholars who contribute to the literature, such as (Byrne, 2000), are from or are influenced by this commission.

There are many more contributions from academics or practitioners, regarding the SOE concept (e.g. CCOH, 2006; CCPH, 2005; Fear, Rosaen, Fishman & Bawden, 2001; Giles, 2008; Maurana, Wolff, Beck & Simpson, 2001; Ray, 1999) or its strategies (e.g. Couto, 2000; Gray, Ondaatje & Zakaras, 1999; Ozanne & Saatcioglu, 2008; Zlotkowski, 1997), however, they are mostly focused on American higher education.

2.2.4. University Community (Public/Civic) Engagement (UCE)

University community engagement, university public engagement or university civic engagement are common terms in the UK and Australian contexts used by academics and practitioners aiming to identify and benchmark university responsibility to local, national or international communities. A considerable amount of literature has been published on the UCE concept; ranging from concept definitions (e.g. Association of Commonwealth Universities, 2001; Delaforce, 2004; Farrar & Taylor, 2009; HEFCE, 2007; Watson, 2007) to benchmark development and evaluation approaches (Charles & Benneworth, 2002; Goedegebuure & Lee, 2006a; Hart, Northmore, & Gerhardt, 2009; Hart & Northmore, 2011; Langworthy, 2009).

Rob Wallis, the national president of the Australian Universities Community Engagement Alliance (AUCEA), answering the question ‘What Do We Mean By “Community Engagement”?’ introduced UCE as the universities’ involvement in a two-way relationship with their communities which causes productive partnerships and results in mutually beneficial outcomes (2006, p. 1). He describes this reciprocal relationship between university and society indicated by UCE as beyond community participation, public service and community consultation.

A major contribution to the definition of UCE is put forward by the Association of Commonwealth Universities (ACU, 2001):

> ***Community engagement therefore can be defined as the mechanism through which universities achieve the goals they have articulated in relation to specific communities in terms of their trinity of basic functions, i.e. teaching, research and service, whether at the strategic university level, or in project specific contexts*** (Delaforce as cited in Goedegebuure & Lee, 2006, p. 7).

In the literature, it is also argued that 'civic education' is one of the educational institutions' responsibilities to their societies. Boyer (1990b) discusses this concept in the higher education setting and highlights a number of characteristics of civic engagement such as: nurturing communication skills in students, providing them with basic knowledge about social issues and democracy, preparing an active learning environment, and assisting students to connect their learning outcomes to their real life.

Gibson and Dixon (2011), after reviewing the literature of academic library engagement, analysing the academic libraries' strategic planning documents and conducting interviews with librarians, developed a definition for the concept:

> ***Sustained, strategic positioning of the academic library to create collaborative, reciprocal relationships with identified partners in order to advance institutional, community, and societal goals; to solve institutional-level and community-level problems; to create new knowledge, new products and services; and to effect qualitatively different roles for academic libraries themselves through impact, integration, and outreach to their varied constituencies. .***

While the above definition is proposed to outline the framework of the concept of community engagement, the scope is one part of universities, i.e. libraries. In this contribution the concept is investigated in two internal and external levels and provides a number of areas as library engagement activities and commitments. These areas include the campus-wide learning initiatives, student retention and success, scholarly communication, institutional repositories, new learning space design/collaborations, data services programs, community partnerships, interdisciplinary academic and research programs, new product/process invention, and return on investment (Gibson & Dixon, 2011).

Although most academics and practitioners define the concept of UCE as being similar to the concept of SOE, or even refer to these concepts synonymously, Wallis

(2006) argues that engaged scholarship is one of the features of effective UCE in which student learning as the primary mission of higher education integrates the research activities to foster social, economic and cultural development.

2.2.5. Sawasdikosol's Definition of University Social Responsibility

The landmark contribution in higher education history regarding the social responsibility of higher education institutions was put forward by Sawasdikosol (2009), who established the USR)Alliance in San Francisco. In this contribution, USR is discussed as a paraphrased version of the concept of CSR. According to Sawasdikosol's USR framework, universities should focus on the specific needs of all distinct stakeholders. The USR Alliance highlighted some of the social responsibilities of the universities as paying attention to the quality of graduated students, social awareness, resolving global warming, transparency in operations and welfare (Sawasdikosol, 2009).

The USR Alliance proposed the global USR concept which aims to promote universities to embrace social responsibility as the fundamental basis for their teaching mission. In this framework, a central part of every subject needs to be the application of social responsibility to that field. Also, besides acquiring expertise in their field of study, each graduate should be nurtured as a completely socially responsible citizen (Sawasdikosol, 2009).

A review of the literature shows that the first published definition for this concept was put forwarded by Reiser (2007). He defines USR as the ethical performance policy of the university through the responsible management of various impacts of the university in interaction with society to improve human development. However, Reiser's definition varies from the contemporary published definition proposed by the Global University Network for Innovation (GUNI). GUNI, an international network in Chile, defines the USR concept as:

> ***the capacity to disseminate and put into practice a series of principles and values, by means of four key processes including management, teaching, research and extension activities*** (Jimenez, 2007)**.**

2.2.6. GUNI and More Recent Definitions of University Social Responsibility

GUNI's definition was referred to by Navarrete et al., (2012) to outline their own definition and understanding of USR, which is the most recent published definition of USR. They define it as:

> ***the capacity to diffuse and implement a series of principles and values, by means of key processes, such as management activities, teaching, research and extension to the community, to facilitate sustainability in its economic, social and environmental dimensions*** (Navarrete et al., 2012, p. 10628)**.**

While Reiser (2007), GUNI (2012) and Navarrete et al (2012) take a broad view of the USR concept, other contributors focus on more specific aspects. For example, according to Stewart (2004), the issues of social responsibility in education constitute content preparation for designing appropriate programs which aim to train students for various vocations and, moreover, ensure that the under-served population has access to these programs. In particular, online learning could be a useful strategy to fulfil social responsibility in education, which results in access for all students.

Vasilescu et al. (2010) is another example in this regard, outlining a general USR model in a universal context. They point out that USR is an ethical approach whereby university students and academic staff are encouraged to embrace the notions of civic commitment and voluntary contribution to social services. The authors believe that one of the main aims of USR is to develop a sense of civil citizenship in order to achieve global sustainable development. The authors developed a USR framework, however, they did not provide a formal definition of the concept.

The most recent contribution where the term USR has been employed to outline the responsibilities of higher education institutions to society comes from Vazquez and Hernandez (2013). These researchers attempted to examine the best practices for USR improvement at the University of Extremadura (Spain). These practices have been investigated in different functions of university, such as teaching, research and outreach. As an example, the researchers refer to course development out of the official curriculum to involve students in the community as a USR good practice in the university's teaching function.

In this context, there are some other terms such as 'social impact/value' which refer to the university's role and contributions to societal and economic growth. Kelly and McNicoll (2011) define this as:

> ***an overall reflection of the 'worth' of higher education to society … overall social value would subsume all the value generated through teaching, research, knowledge exchange and 'identifiable' externalities (broader effects), rather than being something 'separate' or an 'extra' benefit*** (p. 7) **.**

2.2.7. Other Terms and Activities Regarding University Social Responsibility

Many scholars, while discussing higher education and its role in sustainable development, highlight responsibilities of universities in the new millennium. In this section just the most referenced examples of USR have been listed based on the existing literature from around the world:

- Preparing students before course commencement (Harroff & Valentine, 2006)
- Providing high quality education (Ramirez, 2012)
- Continuous evaluation of service quality (Doval & Doval, 2010)
- Monitoring quality of performance and processes (Alexander, 2000; Phipps, Wellman & Merisotis, 1998)
- Improving quality of graduates (Jing, Chang, Hussain, & Chin, 2010; Sawasdikosol, 2009)
- Providing lifelong learning for skill development (Rosa, Abreu, & Rei, 2011)
- Addressing community issues through teaching, research and service provision (Tetrevova, 2010)
- Mobilising university competencies in research and teaching (Harayama & Carraz, 2012)
- Providing access to educational programs for disadvantaged groups (Charles & Benneworth, 2002)
- Contributing to increasing public awareness of sustainability (Harayama & Carraz, 2012)
- Promoting global sustainability (Harayama & Carraz, 2012)
- Fostering sustainable development skills (Charles & Benneworth, 2002)
- Promoting ethics and transparency on activities (Rosa et al., 2011)
- Contributing to combat corruption and other misbehaviours (Rosa et al., 2011)
- Respecting and valuing differences (Rosa et al., 2011)
- Ensuring equal opportunity and treatment (Rosa et al., 2011)
- Promoting accountability (Rosa et al., 2011)
- Developing the safety and health in the work area (Rosa et al., 2011)
- Contributing to environmental preservation (Rosa et al., 2011)
- Promoting and supporting voluntary activities (Marinescu Toma, & Constantin, 2010; Rosa et al., 2011)
- Focusing on local community needs (Hart et al., 2009; Rosa et al., 2011)
- Involving students and faculties with the community (Rosa et al., 2011)
- Using transparency and credibility instruments (Navarrete et al., 2012)

As can be seen, in all of these terms and activities, universities are concerned about the quality of university services as well as collaborating with their communities to improve the quality of life in a sustainable manner. The above terms, definitions and activities are not clarifying the domain of the concept precisely. This is an issue for a common understanding of social responsibility in the context of higher education. The next section provides a critical evaluation of the existing body of knowledge defining the concept.

2.2.8. A Critical Review of the Literature on the Concepts Related to University Social Responsibility

In recent decades, a variety of scholarly discourses have sought in different ways to define, outline and benchmark higher education contributions to the quality of life of its society. In different geographies, the terminology used is different (Figure 2.1). While in the US, the prominent term is SOE, in Australia and the UK the common term for university collaboration to nurture society is community engagement. In Europe and Asia, however, scholars and practitioners refer to the same concept using the term USR which is a version of CSR. While SOE and UCE emphasise the reciprocal collaboration of universities with their community, comprising students, faculties, citizens, and so forth, USR underlines an ethical collaboration not only with the university community, but also with ecology as a significant stakeholder.

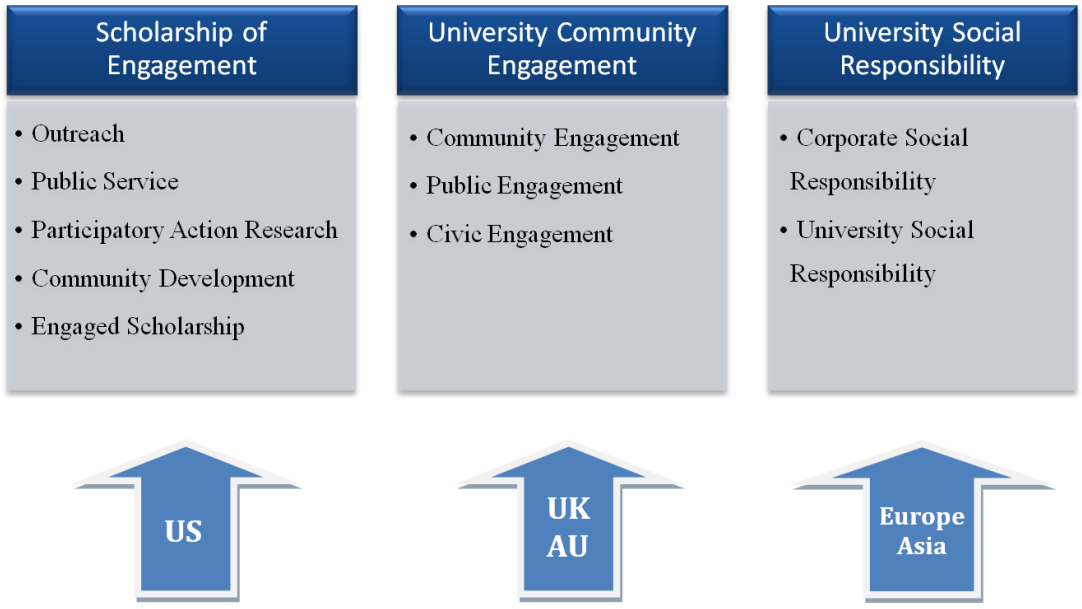


Figure 2-1 The terminology of USR in different areas

A thorough review of the literature relating to the social responsibility concept in the educational domain reveals that this concept appears to apply to a diverse range of polices and activities. It is seemingly both in flux and in fashion and is gaining considerable attention from academics and practitioners through the literature, and has been defined using a variety of terms. This shift in the terminology of the concept of USR may or may not significantly change the ways of interpreting and practising the core notion of the concept (Sunderland, Muirhead, Parsons & Holtom, 2004).

In this literature, there is no attempt to present a globally unified understanding of USR. In a number of instances, the authors propose a definition of USR, thereby resulting in a number of views of the concept. In contrast to research progress on proposing a definition of USR, there has been no research work on presenting an integrative view on what constitutes USR. Hence, there is a noticeable gap in the literature which obscures what USR is and makes the identification of USR factors difficult. Therefore, there is an urgent need to develop a unified understanding to represent the core meaning of the concept.

As the meta analysis of the contributions in USR (Table 2.1) shows, 18 contributors have proposed a definition of USR, however, these approaches failed to take into account the relationship between USR and other synonymous concepts such as SOE, UCE, etc.

Also, as shown in Table 2.1, there are 12 approaches for USR assessment, and in some of them, indicators and components of the concept have been identified. Hence we can clearly see that there is no attempt in the existing literature to develop a broad understanding or an ontology of USR including SOE, UCE, etc. It is important that any ontology development reflects a common, broad understanding of the domain. Therefore, this thesis will define clearly and ontologically the USR concept considering its associated terms and will provide the concept mining result as proof of the concept.

Table 2-1 Meta-literature analysis of existing contributions regarding USR

VUSR Factor	Approach	Concept Definition	Framework Development	Measuring Approach
Quality of Online/ Virtual Education	(WCET, 1995, 2001)	-	√	-
	IHEP Quality Benchmarks (Phipps & Merisotis, 2000)	-	√	-
	(Lockhart & Lacy, 2002)	-	√	√
	(Frydenberg, 2002)	-	√	-
	(J. Lee & Dziuban, 2002)	-	√	-
	(Meyer, 2002)	√	-	-
	(Cavanaugh, 2002)	√	√	-
	(McGorry, 2003)	-	√	√
	(Zhao, 2003)	-	√	-
	(Benson, 2003)	√	-	-
	The Sloan-C (Bourne & Moore, 2001, 2003, 2004)	-	√	-
	(Osika & Camin, 2002; Osika, 2006)	√	√	-
	(Mariasingam & Hanna, 2006)	-	√	-
	(Young & Norgard, 2006)	-	-	√
	Universitas 21 Global(Chua & Lam, 2007)	-	√	√
	(Chaney et al., 2009)	-	√	-
	(Shelton, 2010)	-	√	√
	(J. F. Davis et al., 2011)	-	√	-
	Hodges University (Gordin & Hall, 2012)	-	√	√
Community Engagement	Online Human Touch Framework (Betts, 2008, 2009)	-	√	-
Ethical Performance	(Brey, 2004)	√	-	-
Transparency	(Dalsgaard & Paulsen, 2009)	√	-	-

2.3. Principal Aspects of Social Responsibility in Online Education

The growing request for social responsibility in the higher education field has resulted in developing frameworks and definitions for the USR concept discussed earlier in this chapter. In online/virtual education literature, however, the concept of USR is relatively young. To the best of my knowledge, there is no contribution defining VUSR considering all its dimensions and factors.

Although virtual/online universities have gained much attention over the last two decades, there are major issues which concern the education providers in this area. These issues comprise the quality of education, content development and instructor training, to name a few (Lozier, Oblinger & Choa, 2002). Bower and Hardy (2004) also convey one of the main challenges that distance education in general and VUs in particular have faced, which is lack of support and acceptance by their stakeholders. Trust has been identified as one of the major acceptance factors in online universities (Chung & Ellis, 2003). However, scholars reveal that the lack of trust from students and also employers is a critical issue with these higher education systems (Columbaro & Monaghan, 2009; Sarlak & Abolhasani, 2008).

The above-mentioned challenges with VUs implicitly confer that online education institutions are suffering from lack of attention to the approaches indicating their social responsibility. Identification of the VUSR concept in this domain and comprising a measurement mechanism which enables VUs to quantify their commitment to improve the quality of life of their stakeholders can be a solution to address a part of the challenges confronting them. VUs' stakeholders primarily include students, instructors, support and design professionals and administrators, and secondarily, comprise families, businesses, industries and the community. It should be mentioned that a VU's reasonable social responsibility score can increase consumer trust in online education.

Although no contributions define the concept of VUSR, numerous research works in the literature examine and discuss the quality of online education, community engagement or other VUSR factors (Betts, 2008, 2009; Bowdon & Carpenter, 2011;

Chaney et al., 2009; Joo et al., 2011). In this section, a number of contributions that define some aspects of VUSR and attempt to outline the VUSR factors will be introduced. It is important that in this section, the social responsibility factors that seem to be common for both traditional and online higher education institutions have been considered as well.

2.3.1. Quality of Online/Virtual Education (QOVE)

The growing request for public accountability in higher education systems results in considerable attention to the quality of education as the main indicator of accountability. Higher education institutions nowadays are being challenged to indicate quality within their programs and procedures (Shelton, 2011) and online and distance education systems are not exceptions in this growing trend. While VUs and other kinds of distance education systems are developing all around the world, questioning the quality of these educational systems is an increasing area of attention (Cavanaugh, 2002). There is no doubt that one of students' initial expectations of a VU is to impart high-quality education to them. The community including parents, employers, businesses, industries as well as society also look for VUs' contribution to high-quality education provision.

Quality of virtual education (QOVE) seems to be more complex (Meyer, 2002) and subjective to be defined and measured, because it means different things to different people, from different points of views in different times and places. The difficulty in defining this concept is the result of its nature, as quality inherently is relative and unavoidably rests in the eye of the beholder (Parker, 2005). Therefore, it is sensible to say that the definition of QOVE depends on the different stakeholders' perspectives and interpretations. Mariasingam and Hanna (2006) portray the complexity of this concept in the variety of the meanings, perspectives and different levels of the notion of quality (see Figure 2.2). However, as the concept seems to be one of the main social responsibilities of the VU which is to be measured in this research, all of these views need to be considered. As defined by Meyer (2002), the quality of online education involves preparing multiple paths to learning, respecting learners' differences, providing the opportunities for students to construct meaning

from experiences, to reproduce the meanings, and to examine and re-examine those understandings in new situations.

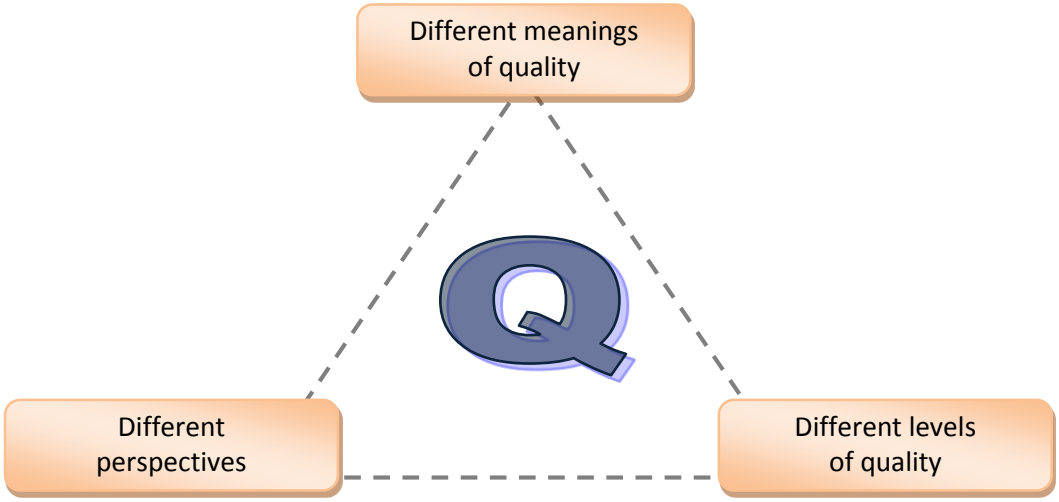


Figure 2-2 Multiple dimensions of the quality of virtual education

Cavanaugh (2002) defines the QOVE in two dimensions, quantitative and qualitative aspects. The first dimension comprises elements such as student performance, completion rates and learners' evaluations of the learning experience. In the qualitative dimension, however, components such as ratings of teaching-learning actions, resources, learning process, events, content and choices provided for students are underlined. Cavanaugh (2002) outlines the QOVE in an iterative cycle constituting three main stages of resources, practices and results (RPR). In the first stage of this cycle, quality is concerned with how to prepare the required resources to meet the online education goals. In the second stage, the perception of quality involves the delivery of instruction practices. While in the last stage, the promise of quality needs to be sought in the results of online education to measure if the educational goals have been achieved. Osika and Camin (2002) point out that QOVE focuses on and supports the needs of its stakeholders. Their proposal of the definition of quality of education in a virtual context is:

> [QOVE] ***has at its core the interaction between faculty and students, surrounded by pedagogically appropriate content presented through a stable technology platform that is supported, both technically and programmatically, to provide knowledge and/or training that is accepted and desired by the larger community*** (Osika & Camin, 2002, p. 281).

According to this definition, to consider and measure the overall QOVE, the researchers should investigate elements such as the quality of interactions between online students and faculties, the appropriateness of the learning pedagogy which delivers online education, the quality of instructional content and the technology delivering the content to online students. Quality assurance is also a renowned concept in the literature of distance education which is defined by the Council of Higher Education Accreditation (CHEA) as an external peer review process in which the quality of tertiary education institutions and their educational programs would be examined (*Accreditation and Assuring Quality in Distance Learning*, 2002). Although quality assurance is defined as an external peer review process, Jung and Latchem (2007) emphasise that it should be driven and accepted internally by online education institutions and it needs to be a primary part of the institutional missions for online universities. The concept is also defined as:

> ***the means by which the institutions or providers set their program goals and measure results against those goals*** (Yang, 2010, p. 367).

In the online education literature, instead of defining the concept of QOVE, most of the contributors attempt to identify its indicators and factors to guide online education providers in quality measurement and improvement. For example, the Institute for Higher Education Policy (IHEP) in its report regarding the quality assurance in online education, refers to the learning content, pedagogic techniques and learning resources as the factors that need to be reviewed in the process of quality assurance (Phipps et al., 1998). These factors also are reported as the quality indicators in other approaches defining and outlining the concept of QOVE. In its fifth report, the Sloan-C, which is a consortium of organisations committed to high-quality online education, highlights some elements of the quality of online education (Bourne & Moore, 2004). In this report, student satisfaction and success, learning effectiveness, incorporating blended learning environments, as well as assessment tools and techniques are considered the main elements of quality in online education (Bourne & Moore, 2004).

Benson (2003) identifies some dimensions of quality of online education from the viewpoint of its stakeholders as overcoming online learning barriers, accreditation of online degrees, efficiency of online course development processes and effective

pedagogy. Some researchers from an administrative perspective define the quality of online education exclusively through a faculty's performance (Husmann & Miller, 2001). However, some others propose that the notion of quality in online learning is a combination of three factors including efficient support of online student and staff, academic outcome, and retention rates (Shelton & Saltsman, 2004). A number of quality indicators are listed by Chaney et al. (2009) such as tstudent–teacher interaction, using active learning techniques, providing prompt feedback, respecting diverse ways of learning, providing student support services as well as faculty support services, commitment in program evaluation and assessment, having clear analysis of audience, and finally, the alignment of online education with the university mission. As the concept of quality of online education is mostly defined by identification of its factors, in this section the most frequent QOVE factors, based on the literature, will be defined in eight categories. It is worthwhile to note that in this research, the terms 'quality virtual education', 'quality online education', 'quality of virtual university' and 'quality of online university' all have been used to refer to the same concept.

2.3.2. Quality of Teaching

Yang (2010) mentions that online education administrators should be aware of the importance of the quality of online teaching in providing high-quality virtual education. The IHEP also identified the quality of teaching as one of the benchmarks for ensuring quality of online education (Phipps & Merisotis, 2000). In this benchmark, components such as the interactions between instructors and students as well as constructive feedback on the student assignments and questions are the essential elements of quality teaching. In some approaches, the quality of online instructors has been determined as the essential factor which influences the quality of teaching. Therefore, it is necessary to consider the academic and professional qualifications of online instructors in the quality measurement processes (Davis et al., 2011). In many references, quality of teaching has been considered as one of the criteria of measuring QOVE (Harroff & Valentine, 2006; Mariasingam & Hanna, 2006; Phipps & Merisotis, 2000; Shelton, 2010; Yang, 2010).

2.3.3. Quality of Learning Techniques/Pedagogy

It has been mentioned that the quality of virtual education is also highly dependent on the quality of online leaning processes (Yang, 2010). Considering learning theories, especially the learner-centred pedagogies in preparation for learning activities has been advised as the learning quality indicators. For instance, designing online modules or segments with different timeframes based on the complexity of learning outcomes; or designing the segments in order to involve learners in high-level thinking skills, i.e. analysis, synthesis, and evaluation as the requirements of their assignments (Phipps & Merisotis, 2000), are some examples of contributions to high-quality learning techniques.

As the lack of human touch, i.e. face-to-face communication, and prompt interaction have been viewed as generally detrimental to the quality of distance education and to virtual learning in particular (Burbles, 2004; Fullerton, Taylor & Watson, 2009; Vamosi et al., 2004; Youn, Chyung & Vachon, 2005), VUs need to develop enriched learning activities. Providing an enriched learning experience in a manner that highly engages student with the learning activities has been mentioned as another indicator for high-quality learning (Burdett & Crossman, 2012). Student engagement with learning activities requires the students to devote a high level of physical and psychological energy to the learning experience which results in a deep understanding and high-quality learning. Chaney et al. (2009) refers to this quality indicator as the active learning techniques which involve online learners in the interactive academic experience and result in increased enthusiasm and achievement beyond expectations.

Integrating real-world situations in learning activities can be considered another indicator of the quality of online learning from the viewpoint of both employers (Carneval, 2007) and students (Lee et al., 2011; Youn et al., 2005). Designing learning content, material and experiences relevant to real-life experiences has been recognised as one of the influential factors that can motivate students to engage with learning efficiently. This integration can be achieved through simulations of real situations and real-life cases in the virtual classrooms. Also, providing opportunities for virtual students to complete their assignments and projects using real-life applications and

information can be a helpful alternative in assisting them to develop personal meaning and achieve high-quality learning (Ally, 2004).

Further to above mentioned features and indicators, Chaney et al. (2009) refers to respecting the diverse styles in which students learn as an important indicator for QOVE. As students usually come to virtual courses with diverse backgrounds and experiences, and they learn through different methods, learning materials need to be available in different forms, allowing them to engage with the learning process at their own pace and with their preferred style. When developing virtual courses and programs, it is essential to incorporate a variety of learning activities and techniques, such as discussion boards, web search activities, etc., to provide a flexible approach to learning. To conclude, it should be noted that the factor of quality of learning and its indicators, e.g. incorporating the learner-centred pedagogies, involving students in active learning techniques, engaging students with real-life activities, as well as respecting diverse learning styles, should be considered when we are measuring the QOVE (Ally, 2004; Burdett & Crossman, 2012; Chaney et al., 2009; Mariasingam & Hanna, 2006; Phipps & Merisotis, 2000; Shelton, 2010; Yang, 2010).

2.3.4. Quality of Course Structure and Development

Following standards for course development, design, and delivery, as well as reviewing the instructional materials periodically to ensure they meet program standards, have been recognised as the main indicators for the quality of course development by IHEP (Phipps & Merisotis, 2000). Technical quality is one of the standards for designing and developing a virtual course which implicitly or explicitly has been questioned in the existing QOVE measurement tools (Young & Norgard, 2006). Nguyen (2008), in her PhD thesis, calls this factor 'technical usability' and quantifies it through a number of indicators such as consistency in course design, coherence of the multimedia used, quality of screen design, quality of navigation tools, help and documentation components, error prevention and recovery, efficiency of usage, user control, compatibility with different systems, reliability, download speed of learning materials, and suitability of the multimedia used. The researcher also lists more indicators for course quality named the 'pedagogical usability factors', including logical organisation of contents, accommodation of learners' individual differences,

support for the development of learning skills, support for experiential learning, support for cooperative learning, support for learners' control, and informative feedback.

Shelton (2010), in her measurement approach for QOVE following the guidelines developed by IHEP, refers to the course structure and course development factors as two different categories. In her quality scorecard, the course structure factor is investigated through a number of indicators mostly related to steps before starting an online program. Advising students regarding the online course to determine if they have the requirements for virtual learning (e.g. self-motivation and required skills for using information technologies) as well as the learners' accessibility to the minimal technology required by the online course are some of these indicators. As Shelton (2010) highlights, all required information regarding the online course, such as course objectives, learning materials, course expectations, learning outcomes, assessment and evaluation approaches, textbook information, and so on, need to be provided for students before the course commences. Also the course syllabus, which contains information on assignments, grade policies, etc., should be provided for online students before they start the course. The quality of course structure and development has frequently been referred to as a main criterion for measuring online education quality (Lee & Dziuban, 2002; Mariasingam & Hanna, 2006; Phipps & Merisotis, 2000; Shelton, 2010).

2.3.5. Student Satisfaction

The Sloan-C in its quality framework for a virtual campus (Bourne & Moore, 2004, 2005) points to student satisfaction as one of the five pillars adopted from the Mayadas (1998) approach regarding the quality of online education. This element has frequently been considered a critical success factor for VUs (Joo et al., 2011), because higher student satisfaction results in more motivation to continue virtual learning (Johnson, Hornik & Salas, 2008; Morgan, 2007). In the literature, student satisfaction of online education has been surveyed considering a number of different criteria such as student interactions in the virtual environment with instructors (Herbert, 2006) as well as other students (Baglione & Nastanski, 2007; Palmer & Holt, 2009), their own performance in the online learning environment (Richardson & Swan, 2003), student support

services including technical, financial and administrative (Herbert, 2006; LaPadula, 2003; Palmer & Holt, 2009), their engagement with learning activities, relevance of instruction, quality of learning materials, virtual evaluation and assessment techniques, technological issues, and institutional issues.

Joo et al., (2011) investigating online students' satisfaction and presence identified the significant predictors of students satisfaction as the teaching presence (the design and organisation of online courses, facilitators of learning and direct instruction), cognitive presence (understanding through collaboration and reflection), and perceived usefulness and ease of use. A number of scholarly works mention that integrating a collaborative learning task in the virtual environment can highly satisfy online learners (Jung, Choi, Lim, & Leem, 2010; So & Brush, 2008). Therefore it can be concluded that the factor of student satisfaction is highly dependent on the learning techniques. Regardless of influencing factors on student satisfaction, this criteria can be considered one of the important indicators for QOVE.

2.3.6. Quality of Student Support Services

There is no doubt that the online student, in comparison to the traditional student, requires more support from the university to engage with the learning environment and activities as they need to take a higher level of responsibility for their learning. LaPadula (2003) defines student support in online education as the guidance and assistance that students can receive from the learning environment above and beyond the learning materials which are an essential part of high-quality online education. In comparison with traditional universities, in VUs,student support services are mostly informational providing 7/24 access to static information. Online advising services, student orientation and early alert systems have been recognised by the Sloan-C as effective practices in online support service provision (Britto & Rush, 2012). In a comprehensive look at the online support service by LaPadula (2003), these services are classified and placed into three categories including academic advising/career counselling, personal/mental health counselling, and services that promote a sense of community. In the recent study, the researcher found that online students desire access to services provided on campus (e.g., an online psychologist, book club, students' newsletter, seminars on time management, etc.).

In order to ensure student engagement with the technology, learning content, instructors, and other students, the VU administrators have to design and develop supportive and motivating techniques for virtual students (Osika, 2006). In such an environment, students receive required information about the online course including admission requirements, tuition and fees, books and supplies, essential skills to undertake the course, and other student support services. They also need to receive training and information that enables them to secure material through electronic databases. Furthermore, in a supportive online learning setting, technical assistance (Harroff & Valentine, 2006) comprising detailed instructions regarding the electronic media, online learning system, and practice sessions prior to the course should be provided throughout the duration of the course. Addressing students' issues and providing informative and constructive feedback on student requests by student service personnel are other necessities of an online learning environment (Lee & Dziuban, 2002; Mariasingam & Hanna, 2006; Phipps & Merisotis, 2000; Shelton, 2010).

This factor also has been reported as the third aspect of quality standards which can be categorised into three divisions including the service provision before students' admission to a virtual course, support services during the online course, and the continual connection between virtual graduates and the virtual university after the course has been completed (Frydenberg, 2002).

2.3.7. Quality of Staff and Faculty Support Services

Preparation of support services for online faculties, like their traditional colleagues, is an essential factor in quality education. Yang (2010) underlines the necessity of training faculties regarding online teaching techniques. This training about the online teaching concept, its procedures, and the appropriate assessment techniques have been recognised as the initial requirements for faculties in online education (Phipps et al., 1998). As the virtual teaching pedagogy is different from classroom teaching, the first requirement for virtual instructors is to pedagogically and technologically be prepared for virtual teaching. In order to represent a beneficial online teaching practice, they also need to be assisted in the different stages of online education. They need training

and assistance to update online technology skills, and to be able to address students' technical issues with the virtual environment. It is also necessary for university administrators to provide technical support for their instructors in course development processes (Phipps & Merisotis, 2000). The faculty support service factor has been recognised as one of the main indicators in the process of quality measurement in online education by a number of academics and practitioners (Bourne & Moore, 2005; Cavanaugh, 2002; Chaney et al., 2009; Lee & Dziuban, 2002; Lockhart & Lacy, 2002; Mariasingam & Hanna, 2006; Phipps & Merisotis, 2000; Shelton, 2010).

The element discussed above has been referred as the 'instructional support' which is one of the essential requirements of online education institutions' success and should be provided for the faculty in their professional development and in developing course materials (Osika, 2006). Faculty support services in online education, especially because of the increasing number of adjunct faculty members, have turned into a critical requirement for quality education (Tareillo, Stephen, & Bizzell, 2012). In recent research, Tareillo and colleagues (2012) attempted to outline a supportive mentoring program for adjunct faculties including four cornerstones: (1) professional development programs aligning to the VUs' missions and visions, (2) effective communication with faculty which continously updates them, (3) teaching the faculties how to build balance in their academic virtual work as well as their personal life, and (4) remineding them how to form their interpersonal relationships based on the core values.

2.3.8. Institutional Support Services

Another important element of quality education and virtual education is the institutional support which can embarace technical support. Although scholars and practitioners defined this element differently, all recognise it as one of the indispensible quality indicators of online education (Juan, 2011; Mariasingam & Hanna, 2006; Phipps & Merisotis, 2000; Shelton, 2010; Yang, 2010). In the IHEP benchmark for high-quality online education, this factor is outlined in sub-elements such as reliability of the delivery system, and developing a centralised system for building and maintaining the virtual education infrustractures (Shelton, 2010). Addressing virtual students' concerns and responding to their questions in a timely

manner have also been considered institutional supports for virtual education (Herbert, 2006). In the online education literature this factor has usually been treated as a separate factor for the quality of education along with student and faculty support, however, Osika (2006) uses the term synonymously with 'program support' which constitutes all aformentioned support plus executive support. Osika (2006) defines program support as:

> ***those [supports] that build the foundation for success across the institution and help provide the support students and faculty need outside of the actual classroom*** (p. 5).

As well as incorporating secure techniques, such as password protection, encryption, and back-up systems, ensuring the integrity and validity of online information are other examples of institutional support that need to be provided by the VU (Juan, 2011; Shelton, 2010).

2.3.9. Quality of Evaluation and Assessment Processes

Developing a high-quality virtual education system requires a comprehensive and sophisticated monitoring and evaluation system (Juan, 2011). The quality of evaluation and assessment processes in a virtual education system has been referred as one of the milstones of assuring the quality of online education (Mariasingam & Hanna, 2006; Phipps & Merisotis, 2000; Shelton, 2010; Yang, 2010). Program evaluation has also been reported as one of the standards of online education (Frydenberg, 2002). In the IHEP benchmark for high-quality online education, this factor comprises sub-elements such as the assesment of effectiveness of the teaching/learning process, enrolment data, costs, uses of technology (program effectiveness) as well as regular review of the intended learning outcomes to ensure clarity and appropriateness (Phipps & Merisotis, 2000).

Chen (2011) outlines a comprehensive evaluation framework for virtual education comprising three main subsystems: the evaluation of students' study (including learners' attitudes and their progress); the evaluation of the teachers' teaching; and the evaluation of learning resources and the operating environment. A clear analysis of primary stakeholders (faculty and students) to identify their needs as

well as their characteristics, abilities, geographic location, accessibility to technology, and their objectives has also been recognised as one of the quality factors (Chaney et al., 2009) to be considered in virtual education evaluation system. As Chaney and colleagues (2009) underline, such a clear analysis of the intended audience will guarantee that the needs of all parties involved in the virtual education will be addressed and considered in the processes of design, implementation and evaluation of the virtual course. Lockhart and Lacy (2002) investigating the faculty and administrators' opinions developed a comprehensive assessment model consisting of seven necessary components for the evaluation of virtual education. Their proposed evaluation models include the following elements:

- institutional readiness/administration (finances, priority and management);
- student readiness (assessment of student readiness and preparation);
- instructional design/course usability (the user interface and accessibility of technology);
- student services (the effectiveness of provided services);
- faculty services (support, outcome measurement and training effectiveness);
- learning outcomes (measurement of learning outcomes);
- retention rates (comparing rates to traditional universities and enrolment monitoring).

Although this factor in some approaches has been limited to evaluation of instructional techniques (Chaney et al., 2009), in others it has been extended to cover all the processes of online education and its elements (Juan, 2011; Phipps & Merisotis, 2000). As Frydenberg (2002) mentions, while the assessment of students' achievement and learning outcomes is normally described as part of the instructional design, program evaluation is frequently listed as a separate component of the quality of online education and is identified as a meta-activity that integrates all the aspects of the virtual education process. Figure 2.3 demonstrates all the elements of the VU evaluation system frequently discussed in the literature.

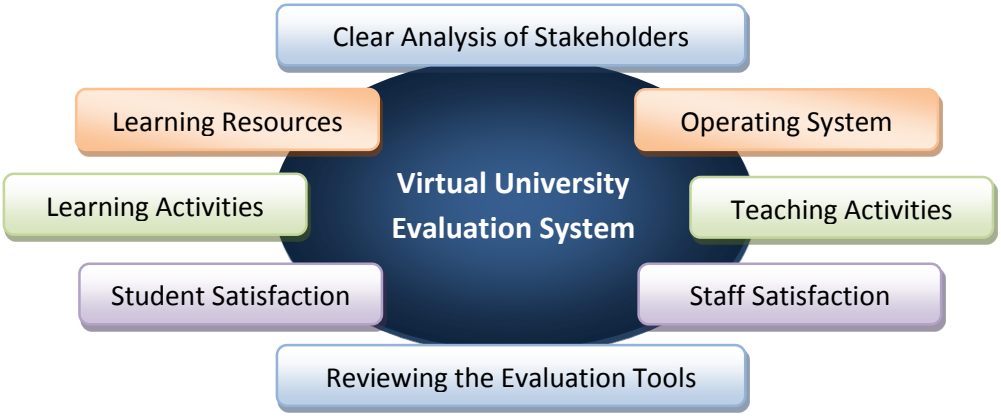


Figure 2-3 The virtual university evaluation system

Every element of online education, such as audience's characteristics, needs and goals, courseware, learning content, the design and development of courses, processes of teaching and learning, student evaluation and assessment tools, all influence and support each other; and all together they serve the QOVE. Therefore it is important for the VU to continually monitor and evaluate these elements.

2.3.10. Quality and Quantity of Graduates

In the literature quality and quantity of graduates are considered components that can represent the quality of higher education (Osika, 2006). This has been defined through indicators such as retention rates, dropout rates, completion rates as well as employability of graduates (Hornman, Mark, Metcalfe, Lampikoski, & Averkamp, 2000; Lockhart & Lacy, 2002; Masoumi, 2010; Osika, 2006; Zhao, 2003).

Retention rates and dropout rates can be affected by different variables which are integrated implicitly or explicitly with the QOVE factors. Berge & Huang (2004) attempted to develop a holistic model for sustainable student retention. They identified the variables by which the dropout and retention rates can be influenced in three main categories: personal (e.g. demographic, skills and abilities), institutional (e.g. missions, policies, budgeting, structural system and social system) and circumstantial (such as bureaucratic interactions, academic interactions and social interactions). The institutional variables which can affect the retention level of online students have also been identified as faculty responsiveness to student needs and requests; the quality of

online teaching; faculty feedback to learners' assignments in a timely manner; institutional response to students' queries in a timely manner; the regularity of student and instructor interaction; the availability of sufficient financial aid; and the student-to-student collaboration opportunities (Herbert, 2006).

In regard to the quality of graduates, the VU needs to ensure that online programs will provide graduates with the skills and knowledge essential for them to be recruited and placed in jobs. The recruitment of graduates into appropriate positions will influence the promotion of online programs and the general public's impression of virtual degrees and certificates (Broskoske & Harvey, 2000). It is important to mention that although in this research the quality of graduates has been referred as one of the QOVE indicators, this notion in the literature has been considered directly as one of the VUSR factors (Doval & Doval, 2010; Sawasdikosol, 2009).

In summary, providing high-quality education is one of the major social responsibilities of VUs which can be investigated through the nine factors discussed, including quality of teaching, learning, online course structure and development, student satisfaction, student support services, faculty support services, institutional supports, evaluation and assessments and, finally, quality of graduates. The QOVE can be considered the major VUSR factor because, as Hornman and colleagues (2000) highlight, quality has a positive impact on society through turning the VUS' attention to the quality of life, the ecology and the protection of natural resources. The quality dimension also underlines the necessity for VUs to organise a clear agenda and policy for their role in society. Furthermore, according the European Commission working paper regarding the role of high-quality higher education, quality is crucial to developing the productivity of higher education which can result in the productivity of the economy and social growth at large (Hornman et al., 2000). Achieving QOVE benefits all kinds of university stakeholders, not only individual students, but also industries, businesses and society in general.

2.3.11. Community Engagement

The second VUSR factor examined in the literature is community engagement. Considering the definitions of the community engagement concept, found in section

2.2.2.2, the following can be seen as aspects and examples of the community engagement of VUs: preparing graduates for good citizenship; developing the employability of graduates; a contribution to human resource development; a contribution to the accreditation of virtual programs; improving students' engagement; work-integrated learning and community development; strengthening faculty engagement with the community and their role beyond classroom instruction; membership of local communities; and providing assistance and donations to the local community.

Mariasingam and Hanna (2006), in their effort to develop a quality benchmark for online degrees, propose a comprehensive model for virtual program development. One of the dimensions of their model for improving online programs targets society's requirements. They propose that in a high-quality online program society needs should be considered, which means the educational programs need to be designed and developed based on society's requirements. They also emphasise that virtual education programs are required to prepare graduates for good citizenship and to nurture students' social responsibility and social awareness. Another instance of community engagement in Mariasingam and Hanna's (2006) model is the university's contribution to human resource development which needs to be one of the objectives of the VU. This contribution can be achieved through the university's mission, including teaching, research and service provision for the community.

The European Association for Distance Learning (EADL) in its guidelines for improving the quality of distance education also points out that distance education (and VU as a part of this paradigm) needs to be concerned about its impact on society. An example of this is the assessment of the role of the university in its society and its engagement with the community through membership of local communities, assistance and donations to the local community, etc. (Hornman et al., 2000). In order to achieve success, VUs not only need to serve their community needs, but also they need their community's support and acceptance. To develop such support and to improve the general public's positive impression, VUs need to be mindful of the accreditation of their programs and the employability of their graduates (Osika, 2006).

Betts (2008) has another approach to community engagement specifically and USR in general. At Drexel University, Betts established and implemented the concept of Online Human Touch (OHT) and outlined its five main areas (see Figure 2.4).

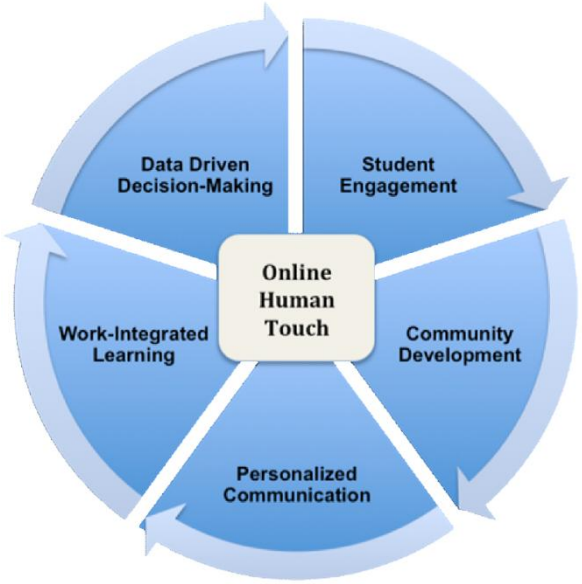


Figure 2-4 The OHT concept for community engagement (Betts, 2008, p. 401)

As can be seen in the OHT framework, three areas of research directly show the online university's community engagement, student engagement, work-integrated learning and community development. Betts (2008) discusses how each area is incorporated into OHT instruction to support the overall framework and provides example for each category. In this framework, for example, student engagement can be achieved through student recruitment in the virtual community, linking students to the online campus community, organising on-campus annual conferences and other support services for virtual learners. As Betts emphasises in this framework, community development is a crucial element in virtual education to achieve high level retention and success. Audio/text introductions of the new students and faculties, weekly discussion boards, virtual teas, group assignments and presentations are some examples of OHT strategies for community development. Based on OHT instructions, learning experiences need to be planned, designed and monitored in such a manner as to involve students with the professional principles and workplace practice to ensure that they can easily transfer their acquired knowledge and skills from study to practice and employment situations (Betts, 2008).

Betts also developed an OHT training and support conceptual framework and implemented it at Drexel University. This framework highlights another element of community engagement, i.e. faculty engagement and their role beyond classroom instruction. Betts (2009) argues that faculty engagement must start with employment and orientation (through virtual meetings), then it must be sustained through community building and continuing faculty development. Working on community-based research projects as well as participating in online activities to benefit the community can be considered faculty engagement practices. It is important to note that the community in this context is not just the university community including faculty and students; it goes beyond this to cover local and global communities. VUs can control resources of time, energy, and intelligence to create mutually beneficial partnerships with industries, for profit and non-profit organisations as well as other groups to improve their community engagement practices (Bowdon & Carpenter, 2011).

Community engagement in the context of distance and online education has been discussed by other scholars (e.g. Odom-Bartel & Wright, 2012), however, it has not been defined clearly and consequently there is no measurement approach outlined in the literature. In contrast, student engagement as an aspect of this concept has a considerable background including both concept definition (Collins & Watts, 2009) and evaluation approaches (Coates, 2006).

2.3.12. Ethical Practice and Performance

Another social responsibility component that has rarely been discussed in the literature is the VU's contribution to ethical performance and practices. Brey (2004) published a report where he attempts to highlight the ethical issues concerning VUs. His primary focus is how VUs can be established and managed in a way that respects and promotes social values and the public good. As Brey says, in the development and management of VU programs, the values such as academic freedom and equality as well as societal values need to be placed at the core of every structure and procedure. In other words, such values need to be taken into account throughout the development of organisational models, curriculum, educational programs, learning management system, administrative policies, and so forth. Mariasingam and Hanna (2006) in their

quality framework also point to the ethical requirements of online education. Two of the ethical requirements the authors recommend are adhering to the standards beyond the minimum obligations and attempting to inform and serve those populations who have the most need for virtual education.

Besides the incorporation of ethical values in their policies and procedures, VUs are expected to contribute to social responsibility by considering cultural differences. As the borders of online education go beyond geographical boundaries, the population of virtual students as well as faculties may extend to a variety of nationalities with different cultural characteristics. This feature requires online education providers to be more concerned about cultural differences. As Mariasingam and Hanna (2006) mention, online programs in regard to their content and delivery should be designed with flexibility to tolerate different social and cultural characteristics and they need to be relevant and suitable for the various requirements of students in different localities.

2.3.13. Transparency in Policies and Procedures

The concept of transparency is one of the most emphasised dimensions of social responsibility of any type of organisation. In the online education setting, because of the lack of face-to-face communication, the demand for transparency is increasingly significant (Shea, Sauli & Pickett, 2006). As noted by Dalsgaard and Paulsen (2009), transparency has three positive effects on the quality of education, including preventive quality improvement (when others can see our performance, we may be encouraged to perform with more quality); constructive quality improvement (when we see others' performance, we may learn from them); and reactive quality improvement (when our data and contributions are accessible for others, they may provide feedback for us). In this context, transparency may diminish the occurrence of low-quality performance and may improve the accessibility of high-quality practices as paragons for university partners as well as rivals (Dalsgaard & Paulsen, 2009). Transparency in the online education domain is discussed as representing different meanings and is involved with different aspects of online education. When outlining virtual education quality frameworks, scholars refer to transparency as one of the essential requirements. For example, in the literature some aspects of virtual education where transparency is required are:

- course objectives and course requirements (Paechter, Maier, & Macher, 2010; Shelton, 2010);
- program delivery and program administration (Frydenberg, 2002);
- student achivements (Shelton & Isernhagen, 2012);
- student assessment processes (Bourne & Moore, 2005; Kerr, 2011; Palmer & Holt, 2009);
- educational processes (Dalsgaard & Paulsen, 2009; Farrell, 2001);
- internal quality assurance mechanisms (Farrell, 2001);
- faculty support (Pfeffer, 2012);
- institutional performance (Shelton & Isernhagen, 2012).

While discussing transparency in online education, authors mostly focus on the primary stakeholders of VU, including students and instructors. Dalsgaard and Paulsen (2009) define this concept as a situation in which students and instructors are made completely aware of and have access to each other's ideas, opinions, interests, concerns, works, references and assignments. In this view, online educators are required to provide a transparent atmosphere to enable learners and teachers to perceive and follow the efforts of fellow students and instructors inside the virtual learning environment and consequently to make them available to each other as resources for their educational activities. These researchers specifically focus on the importance of transparency in cooperative learning practices, where learners working on related projects or assignments have to be able to follow the work of their colleagues. Palmer and Holt (2009) similarly point to the transparency in learning and teaching activities which results in students' satisfaction as well as educational effectiveness.

Pfeffer (2012), in *Virtualization of Universities*, discusses the contexts of digital learning materials, referring to the openness in learning material accessibility. The author postulates that VUs should support instructors to design and also make the learning materials available at least for all other members of VU. He believes that the results of this transparency in learning materials and resources can be a developed

social control among peers and potentially can improve the quality of learning resources and teaching in an academically sound way (Pfeffer, 2012).

While the above-mentioned contributions focus on transparency in learning activities and processes and discuss it within the dimension of online education, others extended its domain to administration. For example, in the US as a result of government involvement in institutional accountability, online universities are asked to be more open and to provide transparent evidence of online student achievement and university institutional performance, to launch approaches for comparison purposes and to benchmark against other universities (Shelton & Isernhagen, 2012). To achieve the prescribed standards of online education and to meet the demand for openness and transparency in online education, VUs must actively be engaged in providing high-quality education (Farrell, 2001). According to the definition of transparency proposed by Ball (2009), there are other aspects to this concept, such as countering corruption, openness in decision-making, or good governance in policies and programs. However, in the reviewed literature of online and virtual education, these aspects of transparency seem to be neglected.

2.3.14. A Critical Review of the Aspects of Social Responsibility in Online Education

A thorough review of the literature of online education generally and the VU specifically revealed that the concept of VUSR has been discussed and defined not as a comprehensive whole, but through its components and factors. In the literature, some of the VUSR components have been recognised as the success factors of online universities such as quality of online/virtual education (QOVE) and transparency (Bhuasiri, Xaymoungkhoun, Zo, Rho, & Ciganek, 2012; Hassanzadeh, Kanaani, & Elahi, 2012; Ossiannilsson & Landgren, 2012).

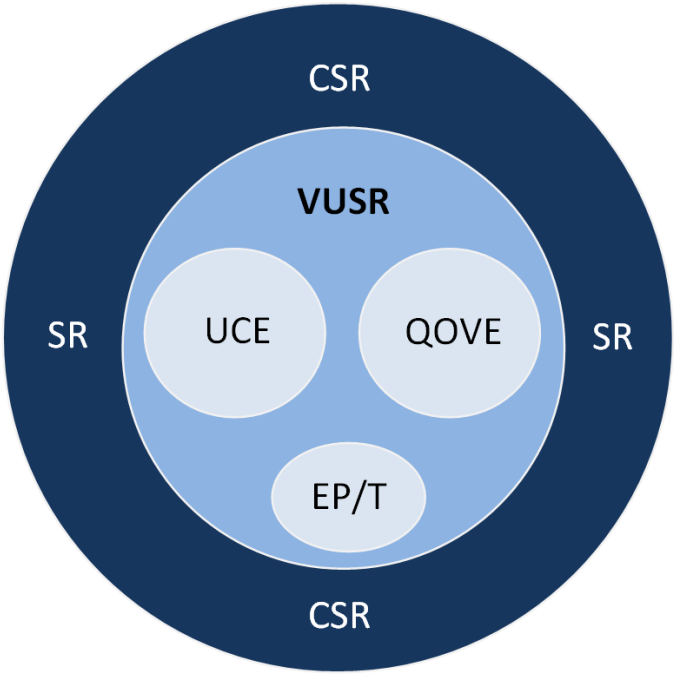


Figure 2-5 VUSR factors in the literature

Figure 2.5 illustrates the VUSR components in the context of the broader concept of CSR/SR. Considering social responsibility of online/VUs as a kind of CSR/SR, the concept appears to consist of components such as UCE, QOVE and ethical performance as well as transparency (EP/T) in policies and practices.

In the reviewed literature, there is no evidence of defining social responsibility of VUs referring to all its dimensions. In each contribution, however, scholars and practitioners attempt to outline some aspects of the concept. Many contributors, while outlining the framework of virtual education or the quality of education, implicitly point to components of social responsibility of online education institutions. Others, based on the existing contributions, specifically regarding QOVE, develop evaluation frameworks. There are also many examples that attempt to measure this essential factor (see Table 2.2).

Table 2-2 Meta-literature analysis of existing contributions regarding VUSR

VUSR Factor	Approach	Concept Definition	Framework Development	Measuring Approach
Quality of Online/ Virtual Education	(WCET, 1995, 2001)	-	√	-
	IHEP Quality Benchmarks (Phipps & Merisotis, 2000)	-	√	-
	(Lockhart & Lacy, 2002)	-	√	√
	(Frydenberg, 2002)	-	√	-
	(Lee & Dziuban, 2002)	-	√	-
	(Meyer, 2002)	√	-	-
	(Cavanaugh, 2002)	√	√	-
	(McGorry, 2003)	-	√	√
	(Zhao, 2003)	-	√	-
	(Benson, 2003)	√	-	-
	The Sloan-C (Bourne & Moore, 2001, 2003, 2004)	-	√	-
	(Osika & Camin, 2002; Osika, 2006)	√	√	-
	(Mariasingam & Hanna, 2006)	-	√	-
	(Young & Norgard, 2006)	-	-	√
	Universitas 21 Global (Chua & Lam, 2007)	-	√	√
	(Chaney et al., 2009)	-	√	-
	(Shelton, 2010)	-	√	√
	(Davis et al., 2011)	-	√	-
	Hodges University (Gordin & Hall, 2012)	-	√	√
Community Engagement	OHT Framework (Betts, 2008, 2009)	-	√	-
Ethical Performance	(Brey, 2004)	√	-	-
Transparency	(Dalsgaard & Paulsen, 2009)	√	-	-

As can be seen in Table 2.2, the most frequently defined and investigated aspect of social responsibility in the literature is the QOVE. This literature shows that the main social responsibility of the VU is to be concerned about the quality of the programs and processes and to ensure their stakeholders high-quality education and excellence. Consequently, there is a growing demand for developing measurement approaches for quality assurance and measurement. However, the importance of other factors of social responsibility seems to be neglected.

Although community engagement is one of the significant pillars of USR, the reviewed literature fails to define and outline this factor in the virtual education setting. Even in the OHT framework, which is the only contribution in this regard, the focus of research is developing an interactive and personalised online education framework in which community engagement has been highlighted as one of the aspects. In this

contribution, Betts (2008, 2009) defines this community engagement through student and faculty involvement in university activities. However, the concept of community engagement as defined earlier in this chapter, encompasses not only faculty and student activities, but all university policies and practices. The community of the university, as mentioned before, goes beyond the students and faculty, and also includes future students, graduates, non-academic staff, families, other universities, citizens and society at large. Therefore, outlining the concept of community engagement of all these groups should be considered, and this is one of the gaps in VUSR literature.

The ethical performance of the VU is another essential factor of VUSR which is underlined by Brey (2003). It should be mentioned the Brey's contribution is the only study so far where respecting and promoting societal values as well as higher education values in VUs are the central focus. Also, transparency, despite its crucial role in VUSR, has not received enough attention from researchers. In most of contributions cited in this review, this component has been referred to briefly as a characteristic of high-quality education. Dalsgaard and Paulsen (2009) in their study focus on transparency in the online learning context, however this approach limits the concept to the learning processes and has been investigated only in the students' communication not the whole VU activities and procedures. Pfeffer (2012) also stresses the transparency factor in the VU, however the scope here is discussed in regard to learning materials. In other words, the author argues that the VU has to act in a transparent manner and provide open access to learning materials for all members of the university. As can be seen, the notion of transparency in this setting has been defined exclusively in learning functions. However, in the context of social responsibility, transparency as one of the critical factors needs to be defined comprehensively to cover all activities, policies and procedures of a VU considering all university stakeholders.

From this discussion, it can be concluded that the concept of social responsibility of the VU has not been defined and outlined seeing all its factors. Although the concept of social responsibility has emerged as an important aspect of organisations in the competitive world, so far there has been little discussion of it in the virtual education field. There is a high demand for online universities to embrace this notion and review

their policies and procedures to represent their contribution to social responsibility. Consequently, developing a comprehensive definition of the concept can be a really valuable contribution to fill the evidenced gap in this literature. Development of such a holistic definition and understanding of the concept is also crucial for preparing the measurement criteria and framework of the VUSR concept.

2.4. Existing Approaches for the Measurement of Corporate Social Responsibility

In the globally competitive world, measurement plays a strategic role in quality and productivity. As social responsibility has become one of the typical issues for sustainable development (Aras, Aybars & Kutlu, 2011), its measurement became more critical for all types of organisations. The literature review reveals that there is extensive research attention regarding social responsibility measurement. The measurement approaches for social responsibility are as diverse as the understandings of this concept.

Analysing this literature reveals that research on the assessment of CSR began as early as 1980, when Tuzzolino and Armandi (1981) attempted to develop a mechanism to measure CSR. They proposed a needs hierarchy framework, imitating Maslow's theory to assess socially responsible activities for an organisation in a business context. However, most CSR measuring approaches have been developed within the past decade (Aluchna, 2010; Aravossis, Panayiotou & Tsousi, 2006; Cancer & Mulej, 2009; C. M. Chen & Delmas, 2010; Coleman, 2011; Costa & Menichini, 2013; Daza, 2009; Dzansi & Pretorius, 2009; Gauthier, 2005; Hopkins, 2005; Igalens & Gond, 2005; Kanji & Chopra, 2010; Levermore, 2011; Obalola & Adelopo, 2012; Panayiotou, Aravossis & Moschou, 2009; Perez, Martinez & Rodriguez del Bosque, 2012; Smeureanu, Dioşteanu, Delcea & Cotfas, 2011; Turker, 2009; Wood, 2010). In modern society, in order to survive and succeed in the competitive world enterprises place increasing attention on their CSR evaluation (Marquez & Fomborun, 2005) in different ways.

In the literature, there are different approaches for measuring CSR. For the purposes of this discussion and analysis, the paradigms for CSR evaluation have been divided into three main categories as illustrated in Table 3, including CSR-based reputational scores approaches, content analysis approaches and scale-based approaches.

2.4.1. CSR-based Reputational Score Approaches

In this approach for CSR measurement, a range of scores are predefined and each organisation receives a CSR score based on rankings by managers. The KLD[1] database, Fortune Index and CSI[2] database are examples of this approach (Abbott & Monsen, 1979). It is one of the most widely used approaches for measuring CSR, however, as Turker (2009) mentions, it is used in a limited number of countries. Furthermore, in their research Maignan and Ferrell (2000) say that these reputational indices are not applicable for measuring CSR in all types of enterprises.

2.4.2. Content Analysis Approaches

In the content analysis approach for CSR measurement, the number of occurrences of certain terms in corporate publications such as annual reports, CSR reports and corporate websites are measured. Subsequently indices are used to transform the total number of occurrences to the CSR scope. Examples of this approach are found in Abbott and Monsen (1979), Hamann et al. (2009) and Gulyas (2009). Unreliability of corporate reports (Ingram, 1980; Rockness, 1985; Turker, 2009; Wiseman, 1982) and disagreement regarding how each report can be quantified (Unerman, 2000) are the main shortcomings of this approach; furthermore, it is not applicable for measuring social responsibility of VUs.

[1] Kinder, Lydenberg, and Domini.
[2] Canadian Social Investment.

2.4.3. Scale-based Approaches

The scale-based approach is more common in the literature on CSR measurement where researchers, by considering CSR factors and indicators, strive to evaluate the CSR of an enterprise. There are two classes:

(a) Theoretical scale-based approach: this class proposes only a theoretical model with no focus on validation, such as Aravossis et al. (2006), Panayiotou et al. (2009) and Cancer and Mulej (2009).

(b) Practical scale-based approach: the alternative approaches for CSR measurement; however, after developing a theoretical framework and proposing a scale, an attempt to validate it is made through its application in a real company. Turker (2009), Dzansi and Pretorius (2009), and Kanji and Chopra (2010) are some examples of this group.

The scale-based measurement paradigm is close to the approach of this study, therefore examples of research where the technique is employed are outlined here. As mentioned before, Aravossis and colleagues (2006) proposed a theoretical scale-based approach. They suggest a methodological framework by which enterprises can evaluate their CSR. The suggested scale evaluates CSR along five dimensions including the environment, society, human resources, shareholders, and finally, customers and suppliers. The approach includes three stages, namely analysing, execution and evaluation can be used by organisations in order to employ an effective CSR plan through their various operations. However, in this framework, the authors do not propose any method to measure the individual CSR factors or to determine the overall CSR of an organisation, but rather discuss how CSR may be deployed in their organisation. Panayiotou and colleagues (2009) enhanced the work of Aravossis and others (2006) by adopting the balanced scorecard (BSC) and the Global Reporting Initiative (GRI) indicators. Another example of the theoretical scale-based approach is proposed by Cancer and Mulej (2009) who, in their study on evaluation of CSR, prospose different CSR factors and indicators that have to be considered in measuring this concept. They presented a multi-criteria model for CSR assessment based on multi-criteria decision-making methods. However, they only referred to some examples and did not propose any method to quantify the individual CSR factors and to aggregate them to determine the overall CSR.

The most recent contribution to practical scale-based approaches comes from Kanji and Chopra (2010). While proposing a conceptual model for CSR, they attempted to develop a holistic and systematic modelling approach for measuring CSR at community, national and international levels. They used two different instruments for collecting and analysing the data, including a CSR questionnaire and KCCSRM[3] software. Since CSR dimensions are not directly measureable, they developed a set of visible variables for each dimension by which CSR could be measured through a CSR questionnaire. The methodology is based on a structural equation modelling technique in which multiple regression aspects and factor analysis are integrated in order to estimate the relationship between a group of criteria at the same time.

Turker (2009) proposes a scale comprising 18 social responsibility factors which are based on stakeholders' views. After identifying various stakeholders and corresponding corporate responsibilities, Turker extracted items from the literature for measuring CSR. Subsequently, he performed an exploratory survey to organise new items. Finally, by conducting a pilot study to validate the scale and factor analysis to eliminate unrelated items, he proposed the final CSR scale. Another approach in this group is that of Dzansi and Pretorius (2009). They conducted a survey in order to develop an instrument for measuring social responsibility for small business entities in the African context. Through a analysis of data, they determined five main factors of social responsibility of small businesses encompassing expected benefits, actual benefits, employee practices, community or customer practices, awareness and performance. They point out that the proposed instrument is designed specifically for the African venture setting and cannot be used in other domains or geographical contexts.

The most recent contribution where the CSR has been developed and also employed to measure the social behaviour of companies was proposed by Costa and Menichini (2013). They attempted to specifically quantify the corporate commitment to social responsibility as perceived by their stakeholders. In this regard, they developed a multidimensional framework that structured the GRI indicators under

[3] Kanji and Chopra Corporate Social Responsibility Measurement.

BSC perspectives. In order to address the subjectivity of human judgment in the measurement process, the authors used fuzzy logic based assessment techniques in a multi-criteria decision-making approach (MCDM). This approach is one of the most recent CSR measurement approaches and is the only one so far in which the contributors attempt to capture the fuzziness of social responsibility factors.

2.4.4. A Critical Review of Existing Measurement Approaches

Table 2.3 summarises the existing CSR measurement approaches and the shortcomings of these approaches. It is important to note that this study obviously focuses on more recent approaches. One of the shortcomings that some contributors did not address is that the scale outlined for CSR assessment is only a theoretical framework. In other words, the proposed scale has not been applied for validation purposes. Some contributors applied their scale in a real corporation and validated it, however they failed to take into account the fuzziness of social responsibility in the measurement process. As the table shows, the main shortcoming of the approaches is that all these measurement frameworks and scales have been proposed to measure the concept of social responsibility in a business context, therefore they cannot be applied in an educational context with different missions. However, the process that they followed to develop the CSR scale in some of the approaches can lead the researcher to improve the framework of metrics development with more knowledge.

Table 2-3 Meta-Literature Analysis of Existing Approaches to CSR evaluation

Approaches	Description	Short comings	Reference
CSR-based reputational scores	Ranking by manager or organisation using predefined scores	• Limited area of assessment • No mechanism for capturing the fuzzy nature of CSR • Not applicable for VUs • The stakeholder's view is neglected	(Abbott & Monsen, 1979) (Maignan & Ferrell, 2000) (Turker, 2009)
Content analysis	Analysing corporate publications such as annual reports, CSR reports and corporate websites	• Unreliability and incompleteness of corporate reports • Disagreement about the best way to measure disclosure • No mechanism for capturing the fuzzy nature of CSR • Not applicable for VUs	Ingram (1980) Wiseman(1982) (Rockness, 1985) Unerman (2000) Hamann et al. (2009) (Gulyas, 2009)
Theoretical scale-based approach	**Methodological Framework:** a multi-criteria approach including three stages of analysing, execution and performance evaluation for measuring CSR	• It is presented for the Greek market only • Theoretical not practical • No mechanism for capturing the fuzzy nature of CSR • Not applicable for VUs	(Aravossis et al., 2006)
	The New Methodological Approach: tt is based on using the combination of the BSC method and GRI[4] performance indicators consisting of the three stages of analysing, execution and performance evaluation for measuring CSP	• Theoretical not practical • No mechanism for capturing the fuzzy nature of CSR • Not applicable for VUs	(Panayiotou et al., 2009)
	The Multi-criteria Assessment Method: it is based on multi-criteria decision-making method which is supported with appropriate computer programs	• Theoretical not practical • No mechanism for capturing the fuzzy nature of CSR • Not applicable for VUs	(Cancer & Mulej, 2009)
Practical scale-based approach	**Business Social Responsibility Scale:** a three-dimensional structure of CSR comprising community involvement, consumerism, and employee relations, which is proposed for small and micro African ventures	• Applied and validated in a limited (African) area • Not applicable for VUs	(Dzansi & Pretorius, 2009)
	Turker Scale: a four-dimensional structure of CSR comprising social and non-social stakeholders, employees, customers, and government for measuring CSR	• No mechanism for capturing the fuzzy nature of CSR • No approach for measuring CSR factors and overall CSR • Not applicable for VUs	(Turker, 2009)
	System Modelling Approach: this approach uses a latent variable structural equations model within the especific frontiers of the organisational strategic planning system to evaluate CSR at community, country and international levels	• The scale is only applicable for corporations in which KCCSRM[5] has been applied. • No mechanism for capturing the fuzzy nature of CSR • Not applicable for VUs	(Kanji & Chopra, 2010)

[4] Global Reporting Initiative

[5] Kanji and Chopra Corporate Social Responsibility Measurement

	Multidimensional Approach: this approach uses a multi-criteria model combined with fuzzy logic techniques	• Not applicable for VUs	(Costa & Menichini, 2013)

2.5. Existing Approaches for the Social Responsibility Measurement in Higher Education

Although the principles of the USR concept are not new and from 1980s emerged as a field of interest in the academic world, little effort has been made to measure this function of higher education institutions. As explained in the previous section, the concept of USR has been defined by different people in many different ways; consequently the measuring approaches resting on these definitions are diverse. It has also been noticed that in each definition the contributors focus on some aspects of USR, therefore the measurement approaches have the same shortcoming. In other words, in each measurement approach only some aspects of this concept (e.g. community engagement) have been quantified. In this section, the existing contributions in the higher education field that attempt to quantify a university's commitment to nurture its community and to somehow improve the quality of life are described.

2.5.1. UCE Measurement Approaches

In these measurement approaches, the contributors developed their measurement framework or benchmarking tools based on the definitions of UCE. Some universities employed benchmark trends to quantify UCE (Scott & Jackson, 2005) in social aspects (e.g. the outputs of community satisfaction surveys, the rate of community use of university facilities, the proportion of graduates who engage in local community, etc.) or economic aspects (e.g. university income through continuing professional education, the number of research grants obtained from external bodies, etc.). In this section, following Garlick and Langworthy's (2008) classification, community engagement measurement approaches are discussed in three broad categories including guided self-evaluation approach with peer review process and; a metric assessment approach based on an agreed list of measures; and hybrid approach.

2.5.2. Guided Self-Evaluation Approaches

Charles and Benneworth (2002) developed a benchmarking tool enabling higher education institutions to quantify their contributions to regional engagement in order to improve economic and social development. Actually the tool aimed to help universities and colleges to measure the regional impact and also to identify the regional issues which needed to be addressed, and the priorities. This benchmarking tool is structured to measure a university's commitment to improving the quality of life of its society in seven dimensions including enhancement of regional framework conditions, human capital development processes, business improvement processes, interactive learning and social capital improvement processes, redistributive processes, cultural development and promoting sustainability.

Based on Charles and Benneworth's approach, each university is asked to undertake this tool in a five-step process of initiation, preparation, workshopping, reporting and dissimination. The process is organised to ensure consensus on the different views of the regional practices in the evaluation procedures and to return the results to the people who should take action on them and consequentlly get the best results. The tool is organised to quantify the regional contribution of a university through 33 benchmarks in seven mentioned dimensions and also includes the outline and guidelines for the university to put it into practice. However, as mentioned, the framework of this benchmark was developed based on the definition of community engagement. As a result, there are more indicators of USR that have been not considered (e.g. transparency in policies and procedures).

As Hart and Northmore (2011) state, one of the most comprehensive contributions to this category was put forward by the University of Bradford in the REAP project. REAP stands for reciprocity, externalities, access and partnership, and is primarily a qualitative self-assessment tool. In their approach, the outline of community engagement based on REAP has been developed. Then, the measurement tool is designed to capture crucial inputs, outputs and outcomes of UCE activities for both university and community partners (Pearce, Pearson, & Cameron, 2007). The challenges with this UCE self-assessment approach are associated with the nature of

some of the UCE practices which do not fit into the measurement tool, as well as time constraints and prioritising of UCE projects and activities.

2.5.3. Metric Assessment Approaches

Goedegebuure and Van Der Lee (2006b), examining six sets of existing indicators and protocols, constructed a matrix of community engagement indicators. In the next step, they employed the indicator matrix to measure the Victorian universities' commitment to community engagement by analysing the universities' reports and other forms of available data (Goedegebuure & Van Der Lee, 2006b). The main shortcoming in this approach, as cited by the researchers, is that the university annual reports usually provide general data rather than more detailed information. Furthermore, the available information in university reports as well as other forms of information are primarily qualitative that quantitative. Dealing with these challenges can make the measurement approach more complicated and might result in less accurate results.

The University of Brighton's auditing and evaluating framework is another contribution for measuring UCE. In order to evaluate the Community University Partnership Programme (CUPP), a three-stage external assessment was commissioned as follows: (1) measuring how CUPP's internal activities work by surveying stakeholders who have been served by the university research helpdesk; (2) evaluating the quality of university-supported projects by surveying both university and community members; and (3) assessing the CUPP impacts on university and its communities by surveying both parties again. All the information in the stages was gathered through interviews (face to face and phone calls), questionnaires and focus groups (Hart & Northmore, 2011).

A recent contribution in this category comes from Gibson and Dixon (2011) who attempted to develop a metrics for measuring academic library engagement. In order to develop the definition of the concept, the researchers designed a three-step approach comprising: (1) a review of the concept literature; (2) an environmental scan of planning documents of public libraries; and (3) interviews with candidates of academic libraries who have been selected based on a number of criteria. Gibson and Dixon (2011) examined the academic library engagement quantitatively and qualitatively in

two levels of internal (within the institution) and external engagements within five groups including mission and strategy, role definition and strategy, management and resource allocation, program effectiveness, as well as outcomes and impacts. The study proposed the engagement metrics for academic libraries in the American context and focuses on a part of higher education institutions (libraries). Therefore, it cannot be applicable for measuring the concept of UCE in its totality.

2.5.4. Hybrid Assessment Approaches

In the hybrid approach, researchers employed a combination of the self-assessment technique plus the metric assessment method. The most recent example of this approach was proposed by the AUCEA for measuring community engagement in Australian universities. The proposed framework includes self-evaluation, community evaluation (using the CSR-based reputational scores approach) and the scale-based approach. The AUCEA's benchmark encompasses goals, policies and measures that are normally allied with high-quality engagement. It comprises an institutional questionnaire, a partner survey and a good practice template which firstly aimed to provide a basic capability for Australian universities to make continuing comparisons with other universities throughout the country. Secondly, the framework aimed to provide the essential components for each university to modify the benchmark in order to have a more comprehensive local measurement approach that would best fit their particular context. It is expected that the quantitative and qualitative assessments carried out by the university will be by way of reciprocated collaboration with its communities (Garlick & Langworthy, 2008; Langworthy, 2009).

There are other approaches that cannot be fitted into the above categories. For example, Ostrander (2004) carried out a comparative empirical study on community engagement activities in five different campuses. Measurement and comparison was conducted through a literature review, observations, interviews with the university community (including administrators, faculty and students), visits and interviews with the local community (e.g. university partners), and content analysis of university documents.

In measuring UCE, the existing approaches used two types of measures including: the quantitative performance indicators such as the number of jobs which the university created, or the number of helpdesk services to the community members; and qualitative measures such as the quality of undertaking the graduate placement processes (Charles & Benneworth, 2002). To develop new metrics and measurement tools, it is essential to consider the most referenced indicators of UCE and to employ them as part of a comprehensive and systematic monitoring system (Scott & Jackson, 2005).

Hart et al. (2009) in their briefing paper reviewing the literature of measurement tools of community engagement declared that the development of effective measurement tools for university community engagement is still at a formative stage. Now, after three years, the literature shows that higher education institutions are still not equipped with a comprehensive measurement approach and tools in quantification of their commitment to community engagement (Hart & Northmore, 2011). The existing tools have been developed for specific types of universities in a limited area. Furthermore, these approaches do not take into account or model all factors and dimensions of USR.

2.5.5. USR Measurement Approaches

Nejati and colleagues (2011), questioning leading universities and their commitment to social responsibility and their role in ensuring a sustainable future, attempted to measure the social responsibility of the top 10 universities. They employed a content analysis approach to analyse the universities' websites. The universities were chosen on the Times Higher Education Ranking 2009. In this approach, the social responsibility of the universities was investigated through seven core aspects, including fair operating practices, community involvement and development, student issues, human rights, labour practice, accountability and transparency in organisational governance and environmental protection. The content of all related university web pages as well as university reports were analysed to determine the university's social responsibility practices. However, the approach failed to take into account the effectiveness of these practices as well as the universities' stakeholders' perspectives.

In fact, the researchers measured university communications regarding social responsibility not the real contributions and their impacts.

Kelly and McNicoll published a report in 2011 where they referred to the concept of USR using the term 'social impact/value'. They reviewed the literature of university social impact evaluation in the UK and attempted to explore and develop a comprehensive approach for measuring the social and economic impacts of UK universities. Kelly and McNicoll called their approach 'socially modified economic valuation' (SMEV), which is an output-based evaluation approach. The SMEV comprises four steps: (1) identification of all university outputs; (2) quantification of these outputs; (3) economic pricing of these outputs; and (4) identification of a set of 'social weights' and application of these weights to the results of the economic evaluation in the third step. The authors believe that because in this framework the social weights reflect the social, ethical and political characteristics of society, they could be changed and modified to align with society's priorities in different periods (Kelly & McNicoll, 2011).

There are some other challenges besides the issue of data availability for measuring social impact in this approach: (1) the methodology is proposed and applied for UK universities, and it cannot be applicable to other universities around the world; (2) as mentioned by the authors, the identification of an economic price for all university output is problematic; and finally, (3) identification of the social weight for the results of the third step is not an easy task and has some issues. The social weight needs to be changed in line with social and political changes, and also might be identified differently by universities in different regions; therefore, it makes the USR evaluation and comparing different universities accordingly more complex.

The most recent contribution to USR evaluation comes from Navarrete and colleagues (2012), in which Chilean universities were investigated to examine how they commit to social responsibility in their initiatives. The researchers carried out an explanatory study and employed a descriptive methodology. In this research, questionnaires and interviews were used for data collection. The interviewees comprised primary stakeholders including students, administrators and academic staff. The universities' public documents and internal documents were also used for further

analyses. In this approach USR evaluation was carried out based on five primary criteria including social, organisational, cognitive, environmental and educational impacts.

The main challenge with this approach was the small number of people involved in the measurement process. As discussed in this chapter, there are different interest groups and individuals who need to be considered when measuring USR, including internal and external stakeholders. Navarrete and colleagues (2012) attempted to examine the social responsibility of Chilean universities considering internal stakeholders, i.e. students, academics and administrators. A total of 31 people were interviewed for data collection, which seems insufficient as the representative of all the universities' stakeholders. There is no evidence of consideration of external stakeholders, such as university partners in business, industries or community members. Another shortcoming with this approach is the qualitative aspect of the study where there is no overall USR score for comparison purposes. Furthermore, although the researchers mentioned that internal and public documents of universities had been analysed, there was neither clarification of the methods of analysis nor explanations for the results. Considering these shortcomings, it should be noted that this measurement approach relied on internal stakeholders' viewpoints, which is valuable but not comprehensive.

Table 2.4 shows an overview of the more referenced and current approaches which aimed to develop an evaluation tool or framework for measuring the social responsibility of a university to its society.

Table 2-4 The existing contributions for measuring USR

Who measured?	How measured?	What has been measured?	Where has been measured?
HEFCE (Charles & Benneworth, 2002)	• Using quantitative and qualitative self-assessment benchmarking tool	Regional contributions by higher education institutions	Universities of the UK
(Ostrander, 2004)	• Content analyses • Interviews with stakeholders • Observations	Civic engagement (student learning, curriculum transformation, community defined priorities, knowledge production)	Five colleges and universities in the US

The Committee on Institutional Cooperation (CIC, 2005)	• This approach is only a theoretical framework	Community engagement (student engagement, staff engagement, institutional commitment, resource commitment, community partnership, social impacts, economic impacts)	Proposed to be used by CIC members
The Russell Group of Universities, 2004 (Goedegebuure & Van Der Lee, 2006a)	• This approach is only a theoretical framework	Third stream activities in two groups of capabilities (knowledge capabilities and facilities) and activities (research, teaching, communications) using 34 indicators	Proposed to be used by the Russell Group members including 10 universities in the UK
(Goedegebuure & Van Der Lee, 2006b)	• Analysing the available information, (published reports and data contained on university websites)	Community engagement (through university plans, reports, resources, governance, and advisory works for community)	Victorian universities of Australia
Bradford University (Pearce et al., 2007)	• Using a qualitative self-assessment tool	Community engagement activities including reciprocity, externalities, access, partnership (REAP)	Bradford University, UK
AUCEA (Garlick & Langworthy, 2008) (Langworthy, 2009)	• An institutional questionnaire • A partner perception survey • Good practice template	Community engagement (addressing local and global issues; providing social, economic, and environmental values through research; delivering high quality education; etc.)	Australian universities (33 AUCEA members)
Brighton University (Hart & Northmore, 2011)	Using an audit tool with: • Interviews • Focus groups • Questionnaires	Public engagement activities (i.e. public access to facilities and knowledge, student and faculty engagements, institutional relationships, etc.)	Brighton University, UK
(Nejati et al., 2011)	• Analysing the available information, (published reports and data contained on university websites)	USR in seven dimensions (fair operating practices, community involvement and development, student issues, human rights, labour practice, accountability in organisational governance and environmental protection)	Top 10 universities based on the Times Higher Education Ranking (2009)
(Kelly & McNicoll, 2011)	• Using an output-based measurement approach	The economic and social values of universities	UK universities
(Navarrete et al., 2012)	• Content analyses • Interviews with stakeholders • Using questionnaires	USR through educational, organisational, environmental, social and cognitive impacts	Chilean universities

As can be seen in the table above, each measurement approach targeted some aspects of this responsibility such as university community engagement activities and strategies; third stream activities; regional contributions; social and economic impacts, and so on. However, there are a number of common dimensions among these approaches (e.g. quality of education, community-based teaching and learning, addressing local issues, environmental impact and community-based research), however, they all are different in the way they outlined USR. These approaches are

also different in the methods and tools they employed to quantify the concept. It is worth noting that all these measurement approaches were developed and employed to quantify social responsibility of conventional universities, mostly in the UK and Australia.

2.5.6. Critical Evaluation of USR Measurement Approaches

Reviewing the literature reveals that each approach for measuring USR strives to quantify the concept based on a specific definition and to figure it according to the researchers' understanding and perception of social responsibility. As discussed in section 2.2, university commitment to improve the quality of life of its society has been referred to using a variety of terms (SOE, UCE, USR, etc.). In some cases, the social responsibility measurement framework has been outlined to meet the specified educational programs for individual universities. Therefore, the proposed approach cannot be appropriate for measurement purposes in VUs.

The second shortcoming in this field is that while measuring social responsibility, different approaches focus on different stages of the process from resources and inputs which a university employs for university activities, outputs, outcomes and finally impacts (see Figure 2.6). Kelly and McNicoll (2011) suggest that the logical approach needs to focus on the output and activities measurement, as the outcomes usually cannot be quantified directly. Across the variety of measurement approaches that have been reviewed in this research, the contributors have focused in a specific point of the illustrated vector. There are considerable CSR, USR, UCE, QOVE benchmarks and assessment frameworks in which the concept of social responsibility of higher education has been measured without considering different levels of university performance.

Figure 2-6 The vector of different levels of social responsibility measurement in the literature

It has been mentioned that social responsibility measurement needs to examine what universities actually do, not just investigate stakeholders' viewpoints. However, the fact is that some universities have contributed to measuring their commitment to social responsibility through surveying their stakeholders' perception only. Table 2.5 shows the variety of techniques by which scholars attempted to quantify this concept. As can be seen in this table, the concept has also been measured by analysing university documents (e.g. content of university websites and reports) or its activities, or by using benchmarks for self-assessment.

Table 2-5 Meta-analyses of contributions for measuring USR

Approaches	Description	Examples	Shortcomings
Content Analyses	Analysing the university reports and website contents; looking for the USR practices based on a number of criteria	• (Nejati et al., 2011) • Victorian universities (Goedegebuure & Van der Lee, 2006b)	• Unreliability and incompleteness of university reports • Disagreement between what university publishes and what university performs • Does not cover all dimenssions of USR • Lack of stakeholders' peceptions
Benchmark Tools for Self-evaluation	A benchmarking tool is developed to assist unis to evaluate their commitment to social development based on a number of indicators	• HEFCE (Charles & Benneworth, 2002) • Bradford University (Pearce et al., 2007)	• Does not cover all dimensions of USR • Limited area of assessment • Lack of stakeholders' peceptions • No mechanism for capturing the fuzzy nature of SR • Not applicable for VUs
Theoretical Framework	Developing a theoretical framework comprising a number of criteria for measuring social responsibility of unis	• (CIC, 2005) • The Russell Group of Universities, (2004)	• Theoretical not practical • Does not cover all dimenssions of USR • No mechanism for capturing the fuzzy nature of SR • Not applicable for VUs
Descriptive Survey	Employing descriptive tools (e.g. questionnaires and interviews) to investigate university stakeholders' viewpoints to see how they perceived university as a socially responsible organisation	• Brighton University (Hart & Northmore, 2011)	• Does not cover all dimenssions of USR • No mechanism for capturing the fuzzy nature of SR • Not applicable for VUs
Hybrid	Combination of two/more approaches of content analyses, surveying university stakeholders, self-assessment tools based on a number of qualitative/quantitative indicators	• (Ostrander, 2004) • Chilean universities (Navarrete et al., 2012) • AUCEA (Langworthy, 2009)	• Does not cover all dimenssions of USR • No mechanism for capturing the fuzzy nature of SR • Not applicable for VUs

Each of these measurement methods has a number of barriers which might cause unreliable results. Every single measure can solve a piece of the bigger puzzle (i.e. the

degree of USR), which needs to be joined to other pieces to outline the whole image of university commitment to improve the quality of life in society. There are a few instances where a hybrid measurement technique (a combination of two or more methods) has been employed. These examples, however, failed to evaluate the concept in its totality as they relied on a limited understanding of tsocial responsibility. It can be inferred that the third shortcoming of the literature rests on the assessment methods for the concept.

2.6. Existing Approaches for the Measurement of Social Responsibility in Virtual Universities

As mentioned earlier, in this chapter the concept of VUSR has been discussed and defined not in its totality, but by its components such as quality of education, engagement, etc. There is much evidence in the literature of an attempt to quantify one of the main social responsibilities of the online university, which is quality of education. There are few examples for measuring other factors of VUSR. This section aims to review these approaches to extract useful insights for measuring the concept.

2.6.1. QOVE Measurement Approaches

The criteria for measuring the QOVE concept in the reviewed literature constitutes quality of course content and design, course development, teaching and learning processes, institutional supports, technical supports, student supports, faculty supports, learning outcomes, the quality of assessment and evaluation, and so forth. These criteria are common among most of the measurement approaches, although each contributor referred to these criteria using different terms. As a more detailed review of quality factors and indicators was given in section 2.3.4.1, the focus of this section is to represent the measurement methods for QOVE evaluation instead of the measurement criteria.

Mitchell (2010) categorised the QOVE measures into four categories: those which surveyed stakeholders' perceptions, consideration of only quantifiable elements, measuring course design elements, and those which assess external

standards. The literature shows that in the existing measurement approaches, researchers employed one or a combination of approaches. In this review, these approaches are categorised into two broad categories based on the perspectives by which the concept of QOVE has been measured: single perspective and multiple perspective measures.

2.6.2. Measuring QOVE from a Single Perspective

In the single perspective category, academics and practitioners measure the concept of QOVE based on a number of predefined criteria. In some cases contributors attempt to consider different stakeholders in the first step, however, in the assessment phase, they all measure the concept based on the perceptions of just one group of stakeholders, such as students, faculty or administrators. Examples of this category are the measurement approaches of McGorry (2003), Young and Norgard (2006) and Hodges University (Gordin & Hall, 2012) as well as Shelton's (2010) quality scorecard.

The two first approaches – McGorry (2003) and Young & Norgard (2006) – measured quality through online students' perceptions employing a survey-based assessment tool. At Hodges University, the QOVE concept was quantified based on the faculties' perceptions using a rubric tool. Shelton (2010), constructing a comprehensive quality scorecard, proposed the tool to be used by online administrators. This means that although the researchers attempted to take into account different dimensions of quality, the scoring process would be undertaken by online administrators. Therefore, the perceptions of students and faculties, who are the primary stakeholders of online education, have not been considered.

2.6.3. Measuring QOVE from Multiple Perspectives

Contributors in this category attempt to measure the QOVE concept considering different perspectives. Lockhart and Lacy's (2002) measurement model is one of the first scholarly published works of this category (Lockhart & Lacy, 2002). To measure the quality of online education in their institutions, Lockhart and Lacy proposed a variety of methods. Considering available data at online institutions, using course

design assessment tools, tracking student grades and retention, surveying online faculty and students, and using students' focus groups are data collection techniques in this approach. The concentric model for evaluation of an internet-based learning program proposed by Osika and Camin (2002) is another example of this category. They proposed consideration of community perceptions as well as student and faculty perspectives. Similarly, Zhao (2003) highlights the role of four groups of online education stakeholders for quality measurement. Zhao proposed a methodological framework to evaluate students, faculty, employers and community perceptions of the QOVE concept in online universities. The methods identified as being useful for the assessment process are the survey-based and outcome assessment techniques.

Another study which proposed multiple perspectives for measuring QOVE was conducted by Universitas 21 Global (U21G) which is a network of 18 global universities in four countries (Chua & Lam, 2007). The process of measurement was conducted through different instrument including surveying student feedback regarding the quality of courseware and the quality of teaching; surveying adjunct faculties' opinions on the quality of courseware, assessment tool and pedagogy; as well as investigating corporate clients' feedback regarding the quality of corporate education delivered to their employees. The measurement framework in this approach is based on the U21G online programs. The most recent published contribution in this category is Quality Matters Rubric (QMR) used at Florida State University (Wise, Jones, Shen & Braswell, 2012). The QMR has been used to get feedback from different stakeholders including faculties and students, as well as course mentors. The assessment techniques in this approach are similar to a survey-based method.

The existing literature on measuring the QOVE concept presents valuable insights into quality measurement, however, there are some challenges in this regard. One of the challenges is that the concept is defined and understood differently by different people, therefore the measurement approach is developed to quantify different understandings of the QOVE concept. Another shortcoming is that according to the reviewed literature, the majority of measurement approaches either focus on some dimensions of quality or employ a single perspective. Consequently, the QOVE has not been considered in its totality from all its stakeholders' perspectives in the

literature. Table 2.6 shows a meta-analysis for the reviewed literature in these categories.

Table 2-6 Meta-analyses of the existing literature for measuring QOVE

Approach	Reference	Perspectives	Methods
Single perspective	(McGorry, 2003)	Students	Survey-based
	(Young & Norgard, 2006)	Students	Survey-based
	(Shelton, 2010)	Administrators	Using Scorecard
	(Gordin & Hall, 2012)	Faculties	Using Rubric Tool
Multiple perspectives	(Lockhart & Lacy, 2002)	• Students • Faculties • Administrators	Multiple Methods
	(Osika & Camin, 2002)	• Students • Faculties • Community	No Methods Provided
	(Zhao, 2003)	• Students • Faculties • Employers • Community	Survey-based Outcome Assessments
	Quality assurance U21G (Chua & Lam, 2007)	• Students • Adjunct faculties • Corporate clients	Multiple Methods
	QMR (Wise et al., 2012)	• Students • Faculties • Mentors	Survey-based

2.6.4. Other Measuring Approaches to Online Education

As mentioned before, the online education literature is sparse regarding other VUSR factors such as community engagement and the ethical contribution of VUs and does not reference measurement approaches in this subject. The quality benchmark of Mariasingam and Hanna (2006) is a valuable contribution in this regard. Although the approach is called a quality benchmark, the proposed framework and its components refer to VUSR components. Mariasingam and Hanna (2006), emphasising the significance of different dimensions of quality as well as different stakeholders' perspectives at diverse levels, propose a comprehensive measurement framework for benchmarking online programs. In their framework, some of the VUSR measurement

criteria are organised under six categories: students, faculties, employers, society, government and institutional requirements. Success of postgraduates' career placement (institutional requirement), cultural contextualisation (necessity for online students), university contribution to continuing professional development (employers' requirement), providing lifelong learning, nurturing good citizenship, developing human resources (society requirements), transparency and ethical contributions, adhering to accreditation standards, protecting copyright, and serving disadvantaged groups (government requirements) are VUSR indicators proposed in this framework.

Mariasingam and Hanna's research is one of the first to address measurement of social responsibility of online universities, however, the approach is a theoretical framework and there is no application and validation for its measure. The approach also has not proposed an assessment method, or data collection. It is not clear who should be involved in the evaluation process to assess the aforementioned criteria. Although, Mariasingam and Hanna's proposed approach has no practical results, it provides valuable theoretical insights for VUSR measurement.

2.6.5. Critical Evaluation of Existing Approaches for VUSR Measurement

Researchers and practitioners have attempted to develop a social responsibility measurement approach in recent decades, however, existing approaches are not appropriate for evaluating social responsibility of VUs as an educational organisation in which education providers endeavour to develop and provide quality higher education opportunities for all students around the world. Based on the reviewed literature, it can be concluded that there is no methodology for measuring the social responsibility of VUs. As Table 2.2 early in this chapter demonstrated, the only aspect of social responsibility of the VU that has received research attention is the quality of online education. The virtual education field has yet to establish a universal understanding of the USR concept, and consequently, there is an absence of a common evaluation tool for the field.

2.7. Summary of the Research Gaps in the Literature

The concept of social responsibility in the higher education context is seemingly both in flux and in fashion and has gained considerable attention from academics and practitioners throughout the literature, which has defined it using a variety of terms. The shift in the concept's terminology may or may not have significant impact on the ways of interpreting and practising the core notion of the concept. It is beyond charitable activities or planting seedlings on World Environment Day. In the educational context, it is about how universities take all possible steps to improve the quality of life of not only students and faculties, but also all citizens of the society.

In order to survive and succeed in the competitive world, enterprises place increasing attention on their social responsibility evaluation in different ways. In this direction, the current study has aimed to develop a measurement methodology for VUSR. Therefore, the literature review is structured to answer two broad questions:

- How is the concept of VUSR defined in the literature?
- How has social responsibility in general, as well as in the educational context, been measured?

First, the key terms have been searched in Google Scholar and other databases. The published scholarly works from 1970 to 2013 relating to the above questions have been reviewed to develop a clear understanding. The initial search results revealed that the concept of social responsibility has not been defined and outlined in the field of online and virtual education. Therefore, further search queries were aimed to find an understanding of the concept in the higher education as well as the general context. The first section of this chapter (2.2.) is organised to present a variety of terms by which the concept of social responsibility has been defined in the literature.

After outlining the general definitions of social responsibility, the next round of search queries were run to see if there was any contribution for defining social responsibility aspects and components in the field of online education. In contrast with the first round of search queries, which found no contribution for VUSR definition, a number of contributions were discovered in which VUSR aspects were outlined. These

contributions are summarised in section 2.3. To measure a phenomenon, it is important to know the limitations and the barriers that the researchers and evaluators have to control. Therefore, the literature was searched to find existing measurement approaches for social responsibility in general (section 2.4) as well as in the educational context (section 2.5).

In the field of online education, however, as there was no holistic measurement approach for VUSR, the literature was investigated to review the measurement approaches for the VUSR factors, such as QOVE, community engagement, etc. Section 2.6 presents a summary of the reviewed measurement approaches. Each section in this review ends with a critical review and a meta-analysis of the existing contributions in order to get to know the issues and shortcomings of the literature regarding the research question.

As can be understood from the literature review, there is a range of different understandings of the concept of social responsibility in the higher education context. In some cases, the concept is abstracted to high-quality education provision and in others it is summarised to community engagement practices. The obvious shortcoming highlighted in this review is the lack of an agreed understanding of the concept among the scholars and practitioners in this area.

Another noticeable shortcoming is highlighted through a review of the measurement approaches. The author believes that in view of the gap regarding definition of the concept, the existing measurement approaches of USR are not capturing the concept entirely. Each contributor focuses on some dimensions and neglects others. Furthermore, the attempts for measuring social responsibility are either aimed at university output or its activities. In some cases the concept has been measured through stakeholders' perceptions or analysing university practices. The author believes that to depict the image of social responsibility of an organisation, it is crucial to take into account not only output and activities, but also resources and input. Furthermore, it is desirable to plan the measurement approach to enable impact evaluation.

As discussed in this chapter, the concept of social responsibility has a variety of definitions and has been understood in many different ways. This uncertainty in defining the concept has its roots in the fuzzy nature of the concept. A fuzzy concept needs to be measured employing fuzzy techniques. However, in the reviewed literature, there is only one measurement approach in the general context (Costa & Menichini, 2013) and no approach in the educational setting which has utilized fuzzy techniques for measuring social responsibility. Therefore, the fourth shortcoming is that in the literature the existing measurement mechanisms fail to take into account the fuzzy nature of the social responsibility concept, especially in the educational setting.

The fuzzy nature of the concept and the variety of perspectives for defining and measuring it requires more deliberation from university managers. The reviewed literature reveals that there is no knowledge-sharing portal where people who have an interest in university operations can exchange their ideas regarding USR.

In summary, the literature review identifies the following shortcomings:

- There is no agreed understanding of the USR concept.
- There is no definition for the concept of social responsibility in the context of the VU.
- There is no comprehensive measurement framework for the concept of VUSR.
- The measurement techniques that have been used through the literature do not consider the fuzzy nature of the concept.
- There is no knowledge-sharing portal to assist researchers, practitioners and policymakers to communicate regarding the domain.

2.8. Conclusion

This chapter represented the survey results regarding the VUSR definition as well as its associated terms. It also provided a thorough review of the existing measurement approaches for the concept of social responsibility. According to this thorough review,

it has been revealed that there are a number of problems involved with the concept measurement in the literature which need to be addressed in the current study. The next chapter of this thesis will define these problems as well as the appropriate approach and method this research takes in aiming to address the identified issues.

Chapter 3_ Problem Definition

3.1. Introduction

The first chapter of this thesis highlighted the significances and advantages of conceptualisation and measurement of VUSR and the need for ontology and methodology development for measuring the concept. The literature about the concept of social responsibility in the higher education context was surveyed in Chapter 2. It also discussed the absence of an agreed definition and universal understanding of the concept of social responsibility in the higher education field, despite its importance. According to the reviewed literature, very few approaches have been proposed for measuring and benchmarking university contributions to social responsibility and its commitment to improving the quality of life of its society. Also, to the best of my knowledge, there is no approach in the literature attempting to define and measure the social responsibility of online or virtual universities in its totality.

In this chapter, the research problem that the current study intends to address will be outlined formally; however, beforehand the key concepts for this problem need to be identified. Therefore, section 3.2 will present a set of definitions for the main terms for the research problem, which will be outlined in section 3.3. In the following section, the defined problem will be discussed in more detail through a number of research issues. In section 3.5, an overview of the solution and the preferred research method for addressing the discussed issues will be presented. Finally, section 3.6 will conclude this chapter.

3.2. Formal Definition of Key Concepts

In order to define the research problem and also to propose the solution framework, a set of special terminologies is required. Hence, all the preliminary concepts used for problem definition and solution formulation throughout the research will be formally defined in this section.

3.2.1. Virtual Education

The term ‘virtual education’ is used in this research synonymously with online education. The researcher defines the concept as one type of distance education which relies on online telecommunication technologies. In this form of education learners and teachers communicate together and interact with the learning environment over the internet. The VU and QOVE are extracted from virtual education and need to be defined.

3.2.2. Virtual/Online University

In this thesis, the terms ‘virtual’ and ‘online’ have been used synonymously alongside the term ‘university’ for the same kind of higher education institutions. Following Ryan, Scott, Freeman & Patel (2000), the researcher defines ‘virtual/online university’ as a web-based higher education institution in which there is no physical structure and which employs all kinds of communication technologies to achieve its missions. In a VU all students, instructors and administrators are distant and they do not have any physical or face-to-face contact. In this kind of university, all sorts of interactions occur through online communication tools such as email, forums, discussion boards, etc. Online universities can have the same functions as traditional universities including teaching, research activities and service provision. However, due to the initial mission of online education, the second function may not be as important as other two.

3.2.3. Quality of Online/Virtual Education (QOVE)

In the current study, QOVE is defined as the measure by which the researcher will be able to signify the value or worth of the educational services that a VU provides for its students. In this measure, the quality of input, resources, processes, as well as output of the VU are considerable. Some of components which contribute to QOVE are the quality of teaching/learning, quality of course content, quality of course design, quality of graduates, and so on.

3.2.4. Social Responsibility

'Social responsibility' in this thesis is defined as any kind of organisation's commitment to improve the life quality of its society. The concept consists of a range of activities as well as policies developed for the benefit for the society not for the profit of the organisations. Providing charities, contributing to professional development of employees, organising public events to benefit the communities, employing people from disadvantaged groups, are just some examples of an organisation's responsibilities to its society.

3.3. Research Questions and Problem Definitions

In the higher education field, as discussed in the previous chapter, the social responsibility score of a given university can assist current and future students and staff of the university in making sure that the university cares enough about them. Therefore, it can be an important criterion for prospective students as well as staff to choose a university for their academic standing. The social responsibility score also can be applied as a significant criterion for universities' ranking which is a powerful driver.

Different contributors have proposed different measurement approaches for quantification of the social responsibility concept in the higher education field. As discussed in the previous chapter, some approaches outlined benchmarking frameworks for a university's engagement with its community at different levels. Engaging with the community and encouraging students and staff to be involved in

community activities and serve their community is one of the crucial dimensions of USR, however, there are other important dimensions that need to be considered once the researcher is measuring the university's commitment to USR. There are other approaches in the literature where the social responsibility of a university has been quantified based its definition in the business context. In this recent approach social responsibility in the educational field has been treated as social responsibility in the business domain. A more recent example of this kind of measurement approach is a content analysis approach proposed by Nejati et al. (2011). In this sort of research, USR has been measured based on the definition of CSR.

Considering the above-mentioned discussion, to measure VUSR, the researcher first needs to define the concept of social responsibility in the virtual education domain. Therefore, it is necessary to develop a formal definition of VUSR that consists of its factors, sub-factors and emphasising the performance indicators and attributes in the online education domain. However, the researcher believes that for quantification of such a concept, having an agreed understanding of the concept based on the comprehensive definition and developing the measurement criteria for VUSR cannot be the ultimate solution.

The reason is that the components and factors that contribute to the VUSR concept can be interpreted in many different ways. For example, high-quality teaching as one of sub-criteria of QOVE will be understood differently in different contexts. In other words, different people judge quality based on their conditions and context. It should be mentioned that the VUSR concept and its components involve uncertainty and fuzziness. Hence, to measure a fuzzy concept, it is necessary to employ fuzzy techniques that can capture the uncertainty of the judgments in the measurement process. As mentioned in Chapter 2, in the literature, there is only one contribution in which fuzzy techniques have been used to quantify the concept of social responsibility (Costa & Menichini, 2013). However, that approach evaluated the concept based on its definition in the business context.

According to the above discussions, the problem that this research intends to broadly address can be defined as developing an ontology-based measurement approach which enables VUs to measure their commitment to social responsibility in

different dimensions while considering the fuzziness and uncertainty of its components. In order to address the broad problem of this study, i.e. methodology development for measuring VUSR, there are a number of issues that need to be addressed. These issues will be explained in detail to provide more clarification regarding the research problem and the possible solutions.

3.4. Issue One: Different Concept Representation of Social Responsibility in the Context of Higher Education

As discussed in the previous chapter, the concept of social responsibility has received considerable research attention from academics and practitioners in different fields throughout the past decades. Given its significance, in the reviewed literature, many people contributed to definitions of the concept of social responsibility using many different terms and incorporating a variety of dimensions, particularly, there is **no common understanding of social responsibility in higher education**. The notion of social responsibility of entities emerged in the business domain as CSR and has been defined to highlight the achievement of economic goals, fostering stakeholder rights, integration of society's and company demands or ethical issue in a company (Garriga & Mele, 2004). In the higher education context, the same term appeared and similar notions have been used to define it. In some cases, the term 'CSR' has been paraphrased to 'USR', referring to similar responsibilities without any specification for the higher education setting. As mentioned in Chapter 2, there are also other terms for the social responsibility of universities in the literature. In different geographies and different higher education systems, the responsibilities of universities to their society have been defined in a variety of ways. Therefore, there is no general consensus on the definition of this concept.

Apparently, the concept of USR lies in the perception of the beholders and it makes the concept even more complex to be conceptualised. This difficulty arises from three dimensions, as shown in Figure 3.1, which includes different meanings of social responsibility, different levels of the concept and different perceptions of the beholders.

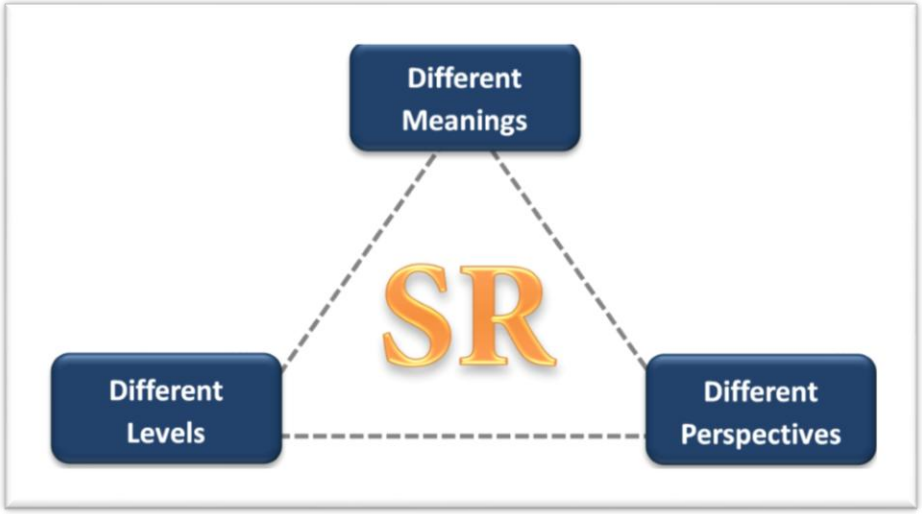


Figure 3-1 Triangle of complexities with the concept of social responsibility

It is clear that to measure such a complex concept, it needs to be defined and conceptualised clearly. However regarding social responsibilities of an educational institution in the tertiary setting, there is no universal understanding and definition. In order to facilitate the achievement of the research goal, this gap needs to be filled beforehand, by developing a comprehensive definition for USR considering the characteristics of the domain.

3.5. Issue Two: No Body of Knowledge in Virtual University Social Responsibility

While the social responsibility concept is perceived to be dependent on the context (Argandona & Hoivik, 2010), what has been defined as CSR (in the business setting) cannot be the same as USR (in the conventional higher education setting). There has been no body of knowledge available for higher education and particularly for on-line/virtual universities. Similarly, what has been defined as the social responsibility of conventional universities does not perfectly fit the online/virtual university responsibility concept (in the online higher education setting). As shown in Figure 3.2, although the terms derived from social responsibility, such as CSR, USR and VUSR,

are related and come from the same root, they are context-related terms and need to be treated based on the requirements of their context.

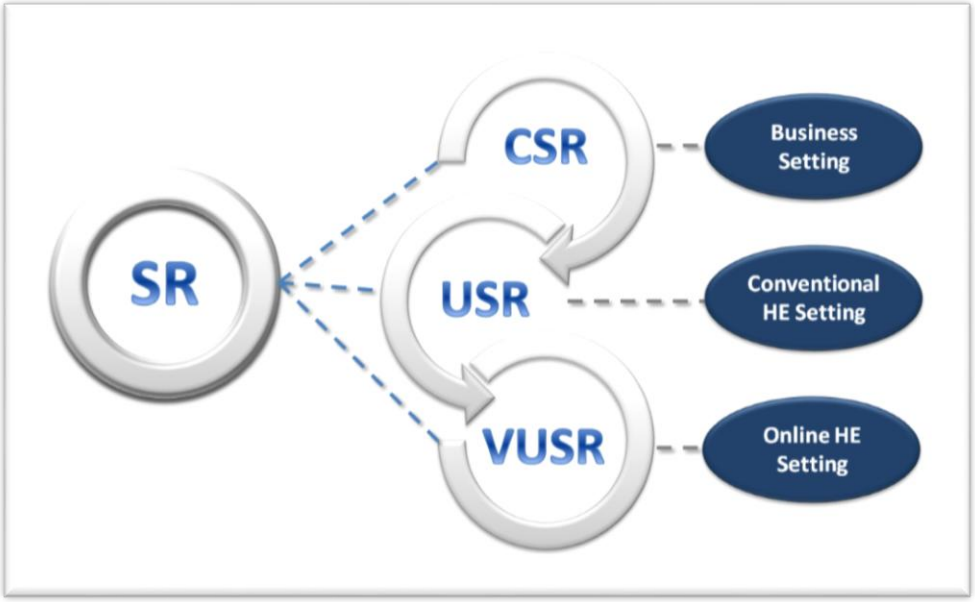


Figure 3-2 The social responsibility associated terms and contexts

The existing contributions for the concept of USR are mostly defining it for the conventional universities which have different policies and practices from online universities. To implement the USR definition for virtual/online universities, it is necessary to find how the concept has been understood by scholars and practitioners throughout the literature.

In the previous chapter, reviewing the scholarly works revealed that the concept of online/virtual university social responsibility is still too young to have a precise definition. There are a number of definitional approaches for factors and indicators that contribute to the concept, such as QOVE, however, to the best of my knowledge, the concept has not been discussed and outlined in its totality. It can be concluded that the second issue that this research needs to address is how to implement the USR definition for VUs to deal with the absence of agreed knowledge regarding the notion of VUSR.

3.6. Issue Three: No Systematic Measurement Methodology for Corporate Social Responsibility for Higher Education and for the Virtual University

There is no doubt that measurement plays a strategic role in the quality and productivity benchmarks in the competitive world. This crucial role provokes for-profit and non-profit organisations into considering the development and employment of measurement tools and techniques to quantify their existence and performance from different perspectives. Social responsibility of corporations and entities is one of the perspectives receiving increasing attention through the last decade (Perez et al., 2012). Because of its importance, particularly in a social context, successful enterprises nowadays strive to quantify and represent their contributions to social responsibility and to make it visible to their stakeholders how they are responsible to them. As social responsibility has become one of the common issues for SD (Aras et al., 2011), its quantification became more critical for all types of organisations.

Although, USR is not a new concept, developing a formal definition and outlining the measurement framework for this concept is a relatively new and emerging field of study. As discussed in Chapter 2, in the literature on the social responsibility concept, different terms have been used to discuss the responsibilities of the university to its society. Therefore, this concept has been defined and outlined by different academics and practitioners in many different ways, and each of them focuses on some aspects of the concept and fails to take into account other aspects. As the definition of a concept establishes a baseline for developing the measurement and improvement frameworks, it is crucial to be comprehensive in covering all essential elements of the concept.

The evidence shows that certain advantages are associated to socially responsible behaviour of an organisation (Obalola & Adelopo, 2012). Therefore, it has become popular in a range of profit and non-profit organisations to attempt to quantify their commitment to social responsibility and to represent their social responsibility performance to their internal and external communities. The literature indicates that social responsibility measurement is important in influencing the future performance

of the assessed entity. The importance of social responsibility measurement can be evidenced by the huge number of research projects being carried out in a variety of domains such as business, industries, etc. The measurement of social responsibility also has been investigated in the higher education domain in different countries.

3.6.1 Social Responsibility Ground Knowledge

Throughout the literature, in each contribution based on a specific definition and understanding of the concept in a particular field, social responsibility measurement criteria have been developed. In the higher education context, the concept has the most measurement approaches as the concept is defined using a variety of terms. In this setting, academics and practitioners attempted to develop benchmarks, questionnaires, and, in some cases, list of guidelines for measuring university commitment to social responsibility. Reviewing these measurement approaches shows that in each of them, contributors focused on some dimensions of USR while neglecting other dimensions. It means that in the reviewed literature, the concept has been quantified focusing on some USR factors, such as community engagement. The literature lacks a holistic measurement approach for the concept of social responsibility of higher education institutions. In some cases, the social responsibility measurement framework has been outlined to meet specified educational programs for individual universities. Therefore, such an approach cannot be appropriate for measurement purposes for other universes.

While measuring social responsibility, different approaches also focused on different levels of the process, such as university resources, inputs, activities, outputs, outcomes or impacts (see Figure 3.3). As previously discussed, the logical approach needs to focus on output and activities measurement, as the outcomes or impacts cannot be quantified directly in most cases (Kelly & McNicoll, 2011). There are considerable CSR, USR, UCE benchmarks and assessment frameworks in which the concept of social responsibility of higher education has been measured without considering different levels of university performance.

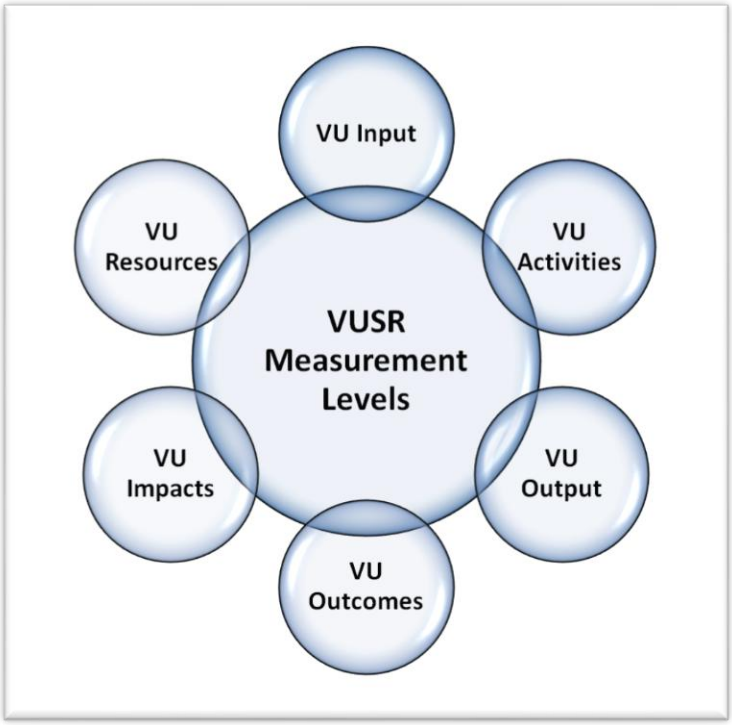


Figure 3-3 The VUSR measurement levels

When it comes to the online university setting, the issue is even more serious. The reason is that in this setting, the concept has not been defined enough to be measured comprehensively. There are a number of research approaches for VUSR components, such as QOVE, however, the concept has not received research attention in its totality. Consequently, the second challenge that needs to be addressed in this study is the absence of a universal measurement framework for the VUSR concept. This means once a comprehensive definition and universal understanding of the concept has been developed, the measurement criteria should to be clarified accordingly. Therefore, based on the identified measurement criteria, the assessment framework needs to be developed to enable online universities to quantify their commitment to social responsibility.

3.6.2 Complexities with Social Responsibility Measurement

The difficulty of quantification of the social responsibility concept has been reported in most evaluation approaches, in both scoring as well as weighting processes (Aravossis, Panayiotou, et al. 2006; Panayiotou, Aravossis, et al. 2009). The multiplicity of social responsibility practices and activities on the one hand, and the

diversity of stakeholders who need to be taken into account on the other hand, can make the measurement of social responsibility a complex process. As mentioned earlier in this chapter, measuring such a complex concept can be highly dependent on the evaluators' viewpoint and their definition of this concept. Besides, the definition of social responsibility can be affected by the universities' organisational model. Consequently, in a comprehensive measurement approach, the structural and organisational features of the university need to be considered.

As the social responsibility policies and practices of higher education institutions are likely to be defined and outlined based on the characteristics and organisational framework of each institution, the measurement tools need to be context driven (Hart et al., 2009). Argandona and Hoivik (2010), collecting evidence from the European business context, postulate that there is not a unique global standard for social responsibility because its content and application will differ from one country to another, will change over time and also will vary among organisations. In another example, regarding measuring university community engagement which is one of the main social responsibilities of a university, Watson (2007) refers to the issue of the variety of approaches for university community engagement at national and international levels. As 'one size does not fit all', stabilising a unique measurement tool for different entities in different countries is not feasible.

The objectives of socially responsibility in an educational context are students, academic and non-academic staff, families, citizens, other educational institutions, local industries and society. Considering the main purpose of a university's contribution to social responsibility, which is improving the quality of life of all aforementioned parties, it can be determined that the best judges for USR can be university stakeholders. The social responsibility of an organisation heavily depends on how its stakeholders perceive the firm's social behaviours (Costa & Menichini, 2013). The social responsibility of a university similarly depends highly on the perceptions of its students, faculties, citizens, and other stakeholders. According to the literature on community engagement, once we want to measure this factor of social responsibility, it is essential to take into account the assessments and interpretations of those with whom the university is engaged (Hart et al., 2009).

To summarise, social responsibility measurement involves a number of complexities, such as the variety of understandings and definitions of the concept, the multiplicity of social responsibility applications in different contexts, the variety of social responsibility approaches at different levels, the diversity of stakeholders who need to be taken into account and the intangibility woven into social responsibility outcomes. In spite of all these difficulties, there is a huge range of contributions in the literature in which scholars and practitioners attempt to develop a measurement framework, metric or tool to quantify the commitment of a variety of organisations to social responsibility. However, none of these is applicable to measuring the concept in the context of online education.

3.7. Issue Four: No Systematic Techniques and Methods for Measurement of Virtual University Social Responsibility

The previous chapter also discussed the need for social responsibility measurement to examine what universities actually do, not just investigate stakeholders' viewpoints. However, the fact is that some universities used questionnaires to measure their commitment to social responsibility using questionnaires to survey only their students' or staff perceptions (Hart & Northmore, 2011; Young & Norgard, 2006). In some approaches, the concept has been quantified using a content analysis approach in which university documents, such as reports and web pages, have been analysed to find the frequency of certain words and to develop indices to map the occurrences of 'social responsibility' (Nejati et al., 2011). Each of these measurement methods has a number of barriers, which might cause unreliable results.

In order to have a more accurate measurement of university commitment to social responsibility, it is necessary to investigate not only university policies but also its practices as well as outputs. Measuring such a wide range of documents, activities and procedures needs many evaluators in the process, which can increase the complexity of the measurement process. It is not unusual to see contradictions between a university's policies and practices. In other words, at the practical level, universities might operate in a manner not outlined in their policies.

Furthermore, measuring outcomes of social responsibility in most cases is impossible, because of the longitudinal nature of these outcomes. That is the reason why the focus of measurement approaches in the higher education context is on the process of university commitment to social responsibility rather than on the outcomes (Langworthy, 2009). If, for example, it is hypothesised that university social responsibility is to nurture more responsible citizens, when and how will universities measure this outcome?

Contribution to social responsibility is expected to have different impacts on the community, including social, economic, environmental and ethical impacts (Dahlsrud, 2006), however demonstrating all these impacts at the institutional level, as well as their quantification, is problematic. Some of the social responsibility impacts are less tangible and cannot be measured by developed tools and benchmarks (Hart et al., 2009).

There is much need for a holistic measurement tool which employs hybrid measurement methods and considers not only what universities publish regarding their resources, activities as well as outputs, but also the stakeholders' perceptions of the university's commitment to social responsibility.

3.8. Issue Five: The Fuzzy Nature of the Measurement of Virtual University Social Responsibility

Considering issue one, it can be inferred that the nature of the USR concept involves uncertainties which makes the concept difficult to be understood by different people in the same way. This uncertainty in defining the concept has its roots in the fuzzy nature of the concept. While measuring such a concept, there are two aspects that the researcher needs to address this uncertainty. The first aspect targets the VUSR measurement criteria where a number of questions might be raised including:

- Do the social responsibility measurement criteria outlined in the measurement framework all have the same level of importance?
- How do the evaluators make decisions about which criterion is more important?
- How can we determine the level significance for each criterion in comparison with other criteria?
- Which techniques can be used for prioritising these criteria?

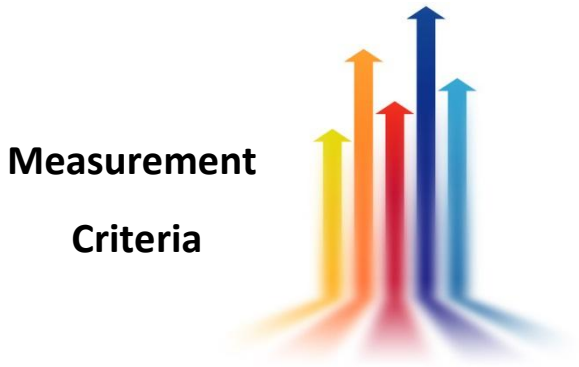


Figure 3-4 Prioritising the VUSR measurement criteria

The second aspect of this issue arises in the assessment process, where the evaluators of the concept need to assign values for the university's performance regarding the VUSR criteria. It is not always easy to quantify performance using crisp values. To measure a fuzzy concept, employing fuzzy techniques seems to be necessary.

Therefore, the holistic measurement tool also needs to be equipped with techniques that facilitate the decision-making in different steps of the measurement process, including prioritising the criteria and assigning values to performance indicators. To the best of my knowledge, in the literature there is no measurement tool for social responsibility of higher education institutions in which the fuzziness of the concept has been addressed through application of fuzzy techniques.

Researchers and practitioners have attempted to develop a social responsibility measurement approach, however, existing approaches are not appropriate for evaluating social responsibility of the VU as an educational organisation in which

education providers endeavour to develop and provide quality higher education opportunities for all students around the world. As such, the literature lacks robust empirical studies to assess online universities' contributions to improve the quality of life of their society, considering the totality of the concept while addressing the fuzzy nature of the concept.

3.9. Issue Six: Validation and Verification of the Ontology for Knowledge-sharing in the Public Domain

It is crucial to validate the frameworks, methodologies and the proposed solutions for research issues 1 to 6. The researcher needs to verify the effectiveness of the proposed solutions and to build confidence that the developed methodology is appropriate for measuring online USR. The validation will enable the researcher to check that the proposed measurement methodology meets the requirements for quantification of the VUSR concept in its general understanding. Also, the effort and the knowledge might be wasted if there is no attempt to share them. So, it seems essential to create a knowledge-sharing portal for the VUSR metrics and its associated components.

3.10. Research Approach and Choice of Research Methodology

In order to address the above-mentioned issues, this research aims to develop a new methodology for measuring VUSR. To achieve this, a scientific and systematic approach is required by which the researcher can ensure the developed methodology is appropriate for measuring VUSR. In this section, an overview of the associated research methodology to this project and the specific methodology for this research will be presented. The reasons for choosing the research methodology will also be discussed.

3.10.1. Research Approach

As the development of the VUSR measurement methodology is a new approach of its type, this research falls under the system development research domain. In system development research methodology, in order to create new things, a system building process should be followed. This process, as outlined by Nunamaker and Chen (1990), constitutes of five main stages:

1. constructing the conceptual framework
2. developing system architecture
3. analysing and designing the system
4. building the system
5. observing and evaluating the system.

In the first stage, the researcher should justify the importance of the research questions. The research question, which needs to be creative and new, should be discussed in a fitting conceptual framework. In the second stage, the architecture of the system will be developed based on the focus of the research and the system requirements. Nunamaker and Chen (1990) believe that the third stage of this methodology is the most important step and involves the application of the relevant body of knowledge, proposing alternative solutions for the research question, evaluating these alternatives and finally developing the design of the system. In order to facilitate the examination of functionality and usability of the proposed system, in the next stage it has to be built. In the final stage, the system will be tested and evaluated and the results should to be interpreted based on the initial framework. In the current research, the discussed methodology will be employed with some modifications. In another words, the researcher will make use of a system development based research methodology that is organised into three broad levels (instead of five) as follows:

1. conceptual level: analysing the existing body of knowledge to generate new ideas and concepts
2. perceptual level: modelling and developing tools and systems through designing a new method
3. practical level: applying the results in the real-world examples to validate and verify the output.

An overview of the research methodology of the current study is illustrated in Figure 3.5. As can be seen, each level of this approach comprises of a number of steps. In the following sections each level and its consequent steps will be described.

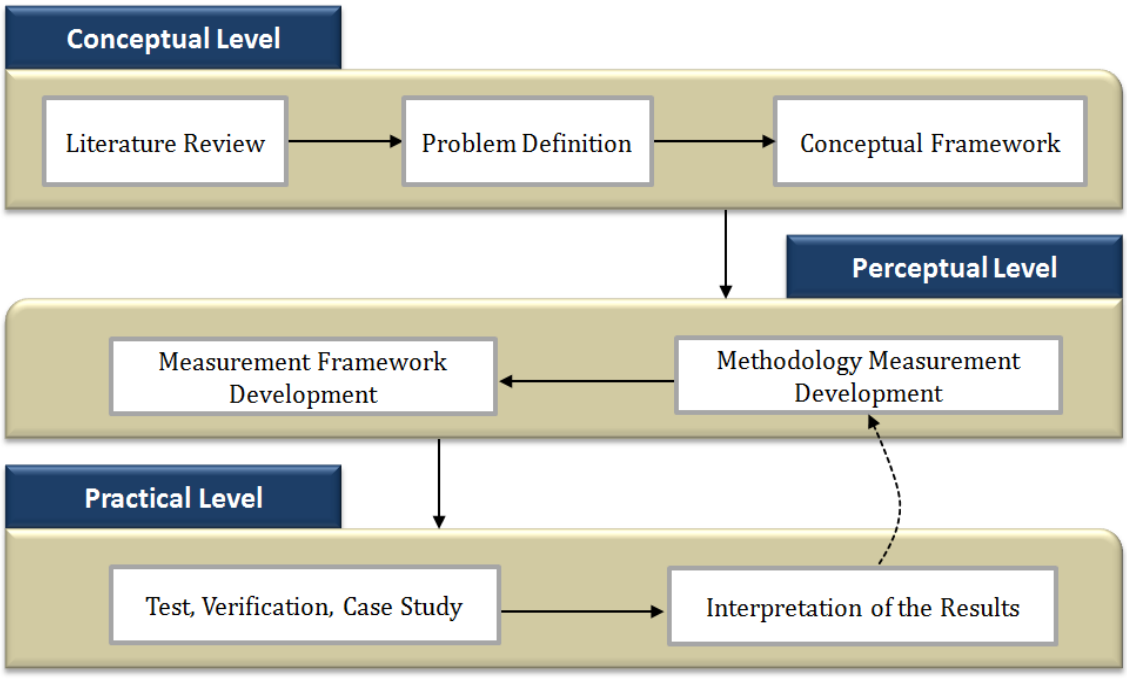


Figure 3-5 The overview of the system development based research methodology

3.10.2. Conceptual Stage

In this level, the research methodology should be designed to generate the new ideas and concepts based on the analyses of the existing body of knowledge. The new idea that needs to be generated in this research is the comprehensive definition of the concept of social responsibility of universities. This comprehensive definition, as mentioned before, is called the ontology. Developing the ontology of a concept relies on the existing meanings and understandings of the concept. As mentioned in 3.4.2, the literature lacks definitions or descriptions regarding of the VUSR concept. However, there are a number of contributions to define the USR concept and a huge amount of scholarly works on CSR which can be used to develop a general understanding of the concept of social responsibility. Considering the aforementioned situation, the conceptual level of this research is designed in two steps (see Figure 3.6) to address the research issues 1 and 2.

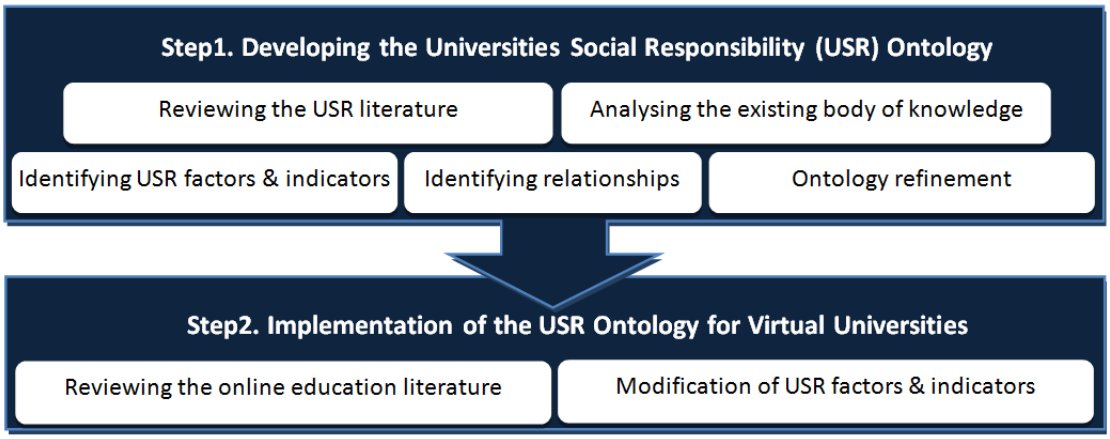


Figure 3-6 The overview of the conceptual level

3.10.2.1. To develop the ontology of university social responsibility

In the first step, in order to develop a universal understanding of the social responsibility concept in the context of higher education (i.e. USR), first of all the literature needs to be reviewed and the related contributions should be identified. Once the existing body of knowledge has been compiled, it needs to be analysed in order to find the components and indicators of social responsibility in the field of higher education. Consequently, the body of knowledge should be analysed to identify the relationships between different components of the concept. The output of these analyses can be employed to visualize the USR ontology, which is the base for VUSR conceptualisation.

3.10.2.2. To implement the USR ontology for the online/virtual university context

The USR ontology developed in the previous step can be used as a guideline for presenting the ontology of social responsibility of a variety of higher education systems. Once the social responsibility components in the educational setting have been identified, they can be used as the key terms to search the literature of online universities and find the existing body of knowledge for the concept of VUSR. The results of this current literature review and the online education experts' viewpoints can assist the researcher in modifying the USR ontology to be applicable for online universities.

The output of the conceptual level of the research approach will be the explicit specification of the concept of social responsibility of online/virtual universities which is generated based on the existing knowledge in the field. The general understanding can be used as the input to the perceptual level of the research approach.

3.10.3. Perceptual Stage

This level of the research approach is aimed to address the research issues 3, 4 and 5 through modelling and developing tools and systems by designing a new method for measuring the concept of VUSR. To achieve this, three steps are required, as shown in Figure 3.7.

3.10.3.1. To develop the ontology-based VUSR measurement framework

In order to develop the ontology based VUSR measurement framework, it is necessary to first identify the measurement criteria. In this regard, the ontology-based VUSR representation assists the researcher in employing the concept factors and indicators for outlining the assessment criteria as well as their indicators. Once this step has been taken, the output will be a detailed framework of VUSR measurement criteria and sub-criteria. As discussed in Chapter 2, one of the issues is that many of the existing measurement approaches for social responsibility developed an evaluation framework, however, they failed to provide clarification regarding the measurement methods and their approach for quantification of the criteria. Hence, in the second step, the researcher will propose the detailed framework for the assessment criteria comprising the performance indicators and attributes.

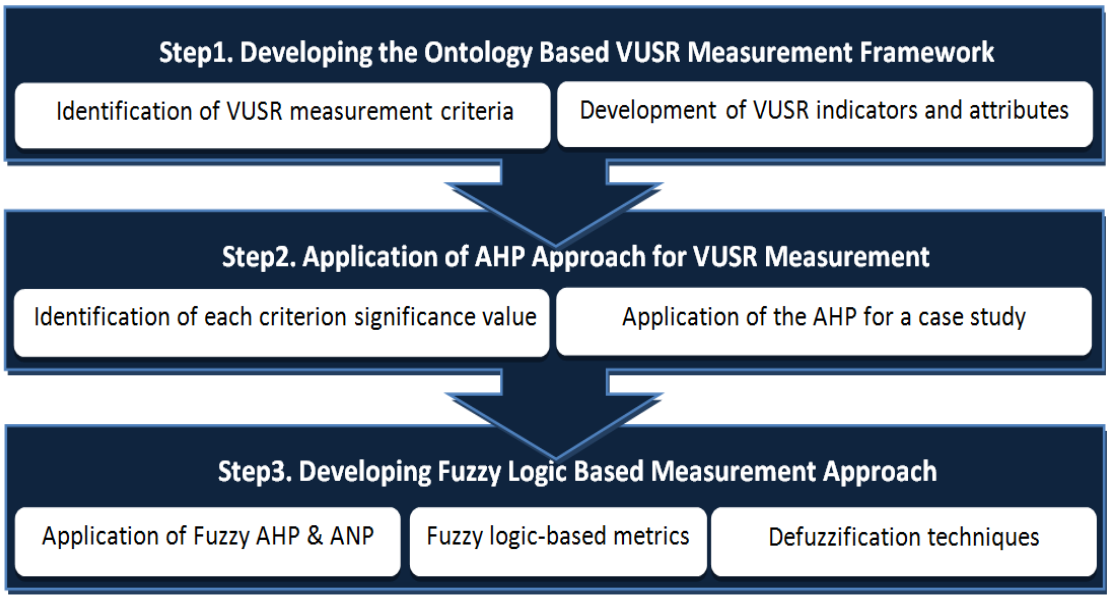


Figure 3-7 The overview of the perceptual level

3.10.3.2. Application of the Analytic Hierarchy Process approach for VUSR measurement

The VUSR measurement criteria that have been defined in the previous step may have different levels of importance. Therefore, it is also crucial to identify the degree of significance of each criterion before determining the measurement process. To address this concern, it is proposed to make use of the Analytic Hierarchy Process (AHP) to determine the significance value for each criterion. In this step, the AHP approach will also be implemented to run a case study for measuring the concept based on the determined values. As the assessment criteria need to be quantifiable to enable evaluators to capture the uncertainty involved with the concept, the measurement approach can take advantage of fuzzy techniques. Therefore, the third step of the perceptual level has been proposed to achieve this requirement.

3.10.3.3. To develop the fuzzy logic based measurement approach

As the concept of social responsibility, regardless of the context in which it is considered, is an ambiguous and subjective concept, a fuzzy approach should be able to tolerate the fuzziness and uncertainty of its nature in measurement processes. If the fuzziness of such a concept is not taken into account, the measurement results can be inaccurate and therefore misleading. To address this concern, in this step, fuzzy logic based measurement techniques are proposed. The researcher employs two different

techniques including fuzzy AHP and fuzzy ANP (Analytic Network Process) to determine the importance of each criterion.

In this step, the fuzzy logic-based VUSR metrics also will be proposed comprising measurement scales appropriate for different variables in the VUSR measurement framework. At the end the defuzzification techniques for computing the final score needs to be defined.

3.10.4. Practical Stage

It seems that by developing the ontology based VUSR metrics, which take advantage of fuzzy techniques, the goal of this study will be achieved. However, the result of the previous steps cannot be reliable unless the developed tool will be applied in real-world examples. In order to validate and verify the output of this research, the practical level of the research approach is proposed which constitutes three steps (see Figure 3.8).

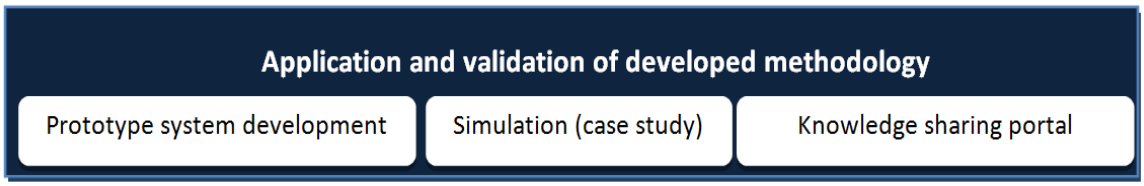


Figure 3-8 The overview of the practical level

The research will be engineering a prototype of the approach for modelling and predicting the VUSR. The researcher will use the engineered prototype for validation purposes. Once the prototype has been developed, it will be trialled using artificial data. In this level, besides providing the proof of the concept for the proposed measurement approach through testing the prototype system, the knowledge-sharing portal will be constructed as proof of the VUSR ontology to share the created knowledge in the web-based VUSR portal.

3.11. Conclusion

In this chapter, after defining the key concepts of the research, the research problem and its corresponding issues have been explained. The chapter also provided the outline of the research approach and methodology in three broad levels and a number of steps. The following chapters will provide more details to clarify each step of the outlined research approach. Specifically, the next chapter will explain the approach of this research in addressing the issues mentioned.

Chapter 4_ Conceptual Framework and Solution Proposal

4.1. Introduction

As discussed in the previous chapters, a number of scholars and practitioners in the reviewed literature contributed to definitions and quantification of the social responsibility of higher education institutions. However, almost all the contributors investigated the concept in conventional universities. It was also revealed that in the online/virtual education setting, some dimensions of the concept have received research attention, but VUSR has not received any attention from scholars in its totality. Consequently, the VUSR concept, its definition and quantification method has remained untouched. In the previous chapter, a number of issues involved with measuring the concept of VUSR have been examined. In this chapter, the overall solution as well as the sub-solutions to address these issues and the overall research question will be proposed. Before this, the concept of social responsibility in the field of virtual education, which is the primary concept in this study, needs to be clarified.

The next section (4.2) provides the researcher's definitions of the key terms used in the proposed solution. Section 4.3 provides a summary of research issues and the possible solutions in this thesis. The research approach to solution development will be defined in section 4.4, followed by the conceptual framework of research in section 4.5. The overall solution to the research problem and its sub-solutions will be proposed in section 4.6. Section 4.7 discusses why ontology development has been chosen for the presentation of the body of knowledge. The ontology definition, choice of ontology development approach and the approach of this study in this regard will be discussed in the next sections, and finally the chapter will be concluded.

4.2. Summary of the Research Issues

As outlined in Chapter 3, the six research issues are identified as:

(1) different interpretation of CSR and, in particular, there are different representations in the context of higher education

(2) no body of knowledge on CSR for higher education, and the VU

(3) no systematic measurement methodology for the CSR for higher education and for the VU

(4) no systematic techniques and methods for measurement for VUSR

(5) the fuzzy nature for the measurement of VUSR

(6) verification of the developed ontology for knowledge sharing in the public domain.

Research issues 1 and 2 are related to the shared understanding and knowledge representation regarding the concept of social responsibility in the general higher education setting, as well as the specific online VU context. The issues indicate that the literature does not contain a universal agreed understanding of the concept of social responsibility, neither for the higher education setting nor for online universities, a special kind of university which is characterised by cyber infrastructure and communication. In order to fill this gap, the researcher believes that the ontology of the concept needs to be developed. This approach results in the formal presentation of the knowledge in such a manner that facilitates and improves knowledge sharing in this context.

Research issues 3 and 4 highlight the difficulties involved with the main purpose of this research, i.e. the social responsibility measurement for the context. The absence of a comprehensive measurement framework as well as an holistic assessment method in the literature are significant issues that need to be addressed in this thesis. The nature of these issues and the complexities involved with them demand the development of an ontology-based measurement framework in which different aspects of the concept as well as its different levels have been considered. The measurement framework is also required to contemplate the detailed criteria and sub-criteria for the process of VUSR.

Research issue 5 indicates the uncertainty involved with human judgment while measuring a fuzzy concept like social responsibility. The nature of the concept may cause some confusion in the phase of prioritising measurement criteria or the scoring, as it is not easy to assign crisp values for the measurement of a fuzzy concept. To deal with this kind of issue, the researcher needs to employ soft computing techniques which not only facilitate the decision-making aspects, but also address the fuzzy nature of the concept by using fuzzy-based techniques.

Finally, **research issue 6** highlights the necessity of evaluation and verification of the created knowledge regarding concept definition, measurement framework as well as the proposed methodology. It also highlights that the created knowledge in the field needs to be shared through a knowledge-sharing portal to enable use and dissemination of the knowledge.

4.3. Solutions Development

In order to establish the conceptual framework of this research, which is developing the VUSR body of knowledge and based on this knowledge, to develop the measurement methodology for VUSR, we start by building the knowledge domain in this area. However, since the foundation knowledge for the social responsibility concept in the context of the online university is not rich enough to assist the researcher in knowledge development, the concept in a broader context needs to be considered. Investigating the higher education domain as the parent context for online education can assist the researcher in outlining the domain of the concept of VUSR. The thorough review of the USR concept in Chapter 2 revealed that in the higher education field the definition of the concept also has some issues. These issues directed the researcher's attention to the broader context which is considering the definition of social responsibility in the business context (CSR) as well as the general setting. Therefore, the researcher's approach to the problem's solution regarding the VUSR definition constitutes consideration of the general understanding of the social responsibility concept, analysing the USR concept definition and developing the definition for the VUSR concept (see Figure 4.1).

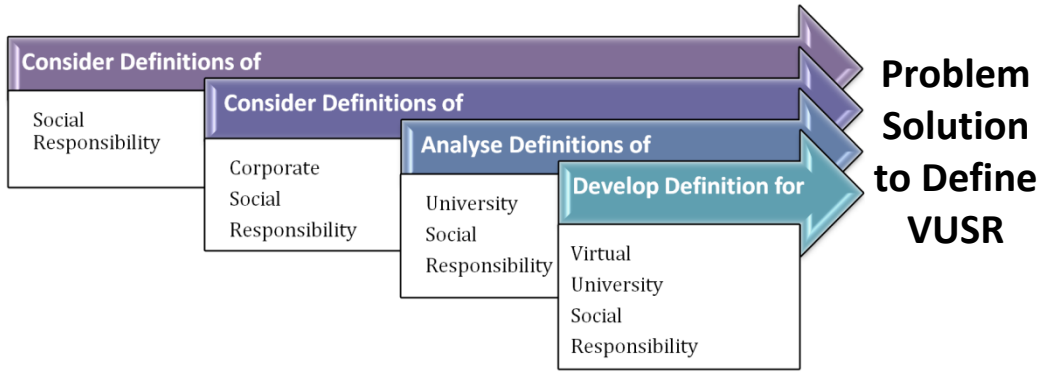


Figure 4-1 How to develop the VUSR concept definition

A similar approach can be helpful in developing the measurement methodology for the concept of VUSR. The existing measurement approaches for social responsibility in the general context, the business setting and, specifically, in the higher education domain assist the researcher in finding the broad solution of this thesis. Once the definition of the concept has been developed, it can be used to figure out the VUSR's principal aspects for which there are measurement approaches in the literature. All the benchmarks, methods and frameworks that have been employed throughout the literature for measuring social responsibility, CSR, USR and VUSR principal aspects (Figure 4.2) will be considered to develop the VUSR measurement framework and methodology.

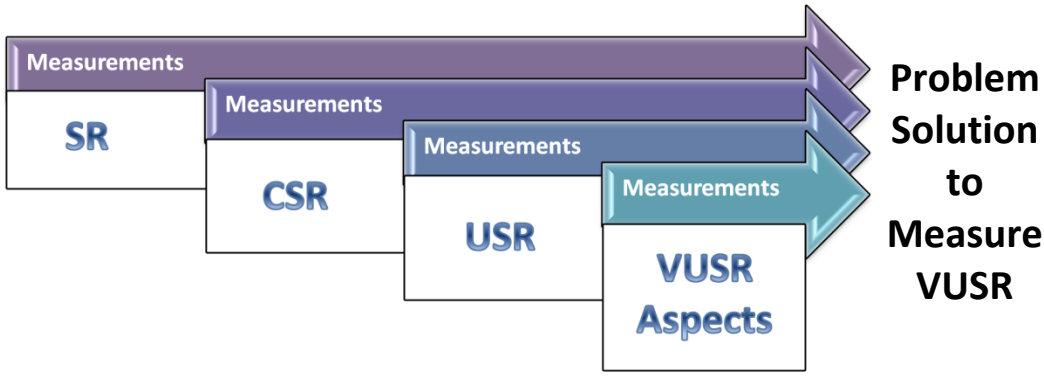


Figure 4-2 How to develop the VUSR concept measurement approach

Once the above steps have been taken, the VUSR measurement framework and methodology will be developed. As shown in Figure 4.3, the measurement framework and methodology are expected to encompass a number of components. The initial component of the framework includes the VUSR principal aspects and their associated

measurement criteria. These criteria need to be identified in different dimensions of the concept.

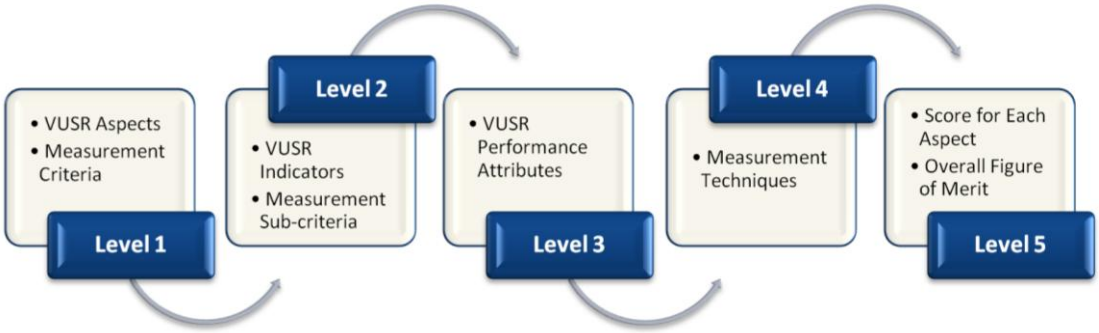


Figure 4-3 The VUSR measurement sequences

The framework also needs to present the indicators for each criterion as well as VUSR attributes aligned with each indicator. The measurement methodology also needs to include the measurement techniques that facilitate the quantification of the concept. Finally, this measurement methodology needs to be developed in such a way that virtual university managers will determine the VUSR score for each aspect of the university performance as well as overall figure of the merit that the university achieved in VUSR.

4.4. Conceptual Framework

Considering the approach of this thesis regarding solution development, it can be inferred that in order to achieve the goal, which is the shared agreed knowledge and measurement for virtual or online universities' commitment to CSR, a number of scientific and technical components are required as part of an overall workable solution. The conceptual framework outlines these components and the direction of the research of this thesis (see Figures 4.4 and 4.10).

In the 1st part of the conceptual framework (top left box, Figure 4.4), the researcher needs to outline the ontological presentation of the concept. In this regard, a number of tasks are required, the first of which is to define exactly what the ontology of the concept is going to cover. Ontology in different domains has different meanings and comprises different components, therefore the researcher needs to clearly present

the meaning of 'ontology' in this framework. The most important output expected from ontology engineering in this research is to identify the aspects of the VUSR concept. In this regard, the researcher is also required to determine the approach of the study for ontology generation.

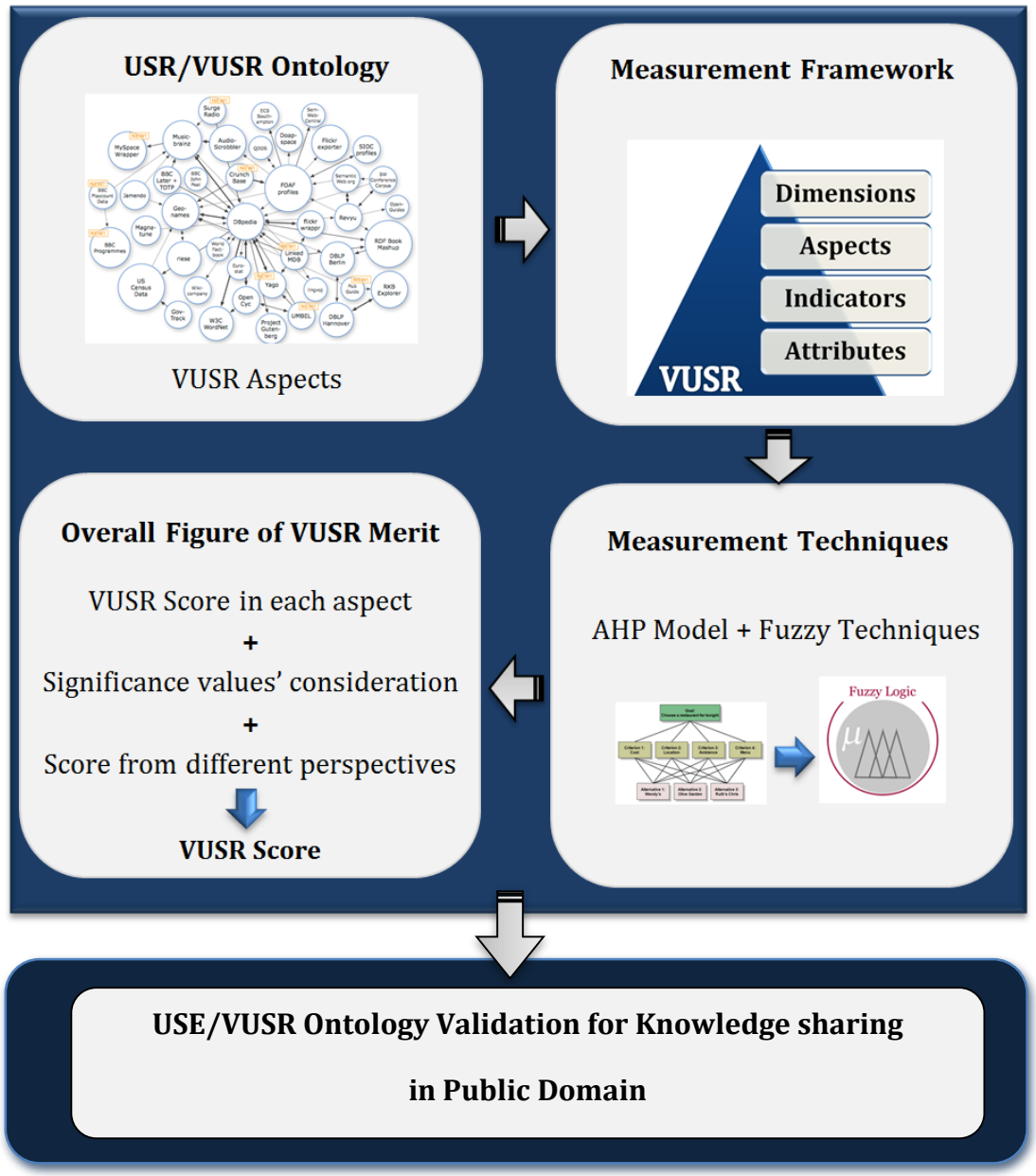


Figure 4-4 The conceptual framework of the VUSR measurement methodology

The 2nd part of the conceptual framework (top right box, Figure 4.4) contains the measurement framework development for the VUSR concept. As can be seen in the above map, the measurement framework is expected to include VUSR dimensions, aspects and indicators as well as performance attributes. Placing the concept

dimensions at the top of the hierarchy, performance attributes at the bottom and two other elements in between, points to the extent of these components in the measurement framework.

The 3rd part of the conceptual framework indicates the measurement techniques that will be employed in this thesis for the evaluation of the concept VUSR. The highlighted techniques are the AHP model and fuzzy logic techniques for pairwise comparison. Attaching these two current dimensions together can result in reaching the last dimension of the conceptual map.

The 4th part of the conceptual framework shows how the overall figure of VUSR merit can be attained. Three important components in this dimension are the score that has been achieved regarding each aspect of the VUSR concept, the score that has been attained from different stakeholders' perspectives and consideration of the significant value of each aspect.

Finally, **in the 5th part of the conceptual framework** is the validation of the ontology concepts for CSR, USR and VUSR developed or created from this thesis, including CSR/USR/VUSR knowledge and the knowledge-sharing portal for the public domain which is intended to help dissemination of the knowledge.

All these dimensions and their associated tasks and elements will be discussed in detail in the following chapters. Considering this map the solution overview of the thesis for the research issues can be defined as follows.

4.5. Ontology as a Foundation for Building the Body of Knowledge

In Chapter 3, the researcher discussed **issues 1-3** as involving a deficiency in the knowledge representation of the concept and as the solution having the characteristics of ontology generation. Therefore, ontology development has been chosen as the fundamental part of the solution and, consequently, the VUSR knowledge representation is the major part of the discourse.

Noy and McGuinness (2001) state that an ontology can define the common vocabulary which is required for sharing information in each domain. They outline some of the reasons for ontology development, such as sharing a common understanding of the information structures among people, making domain assumptions explicit, analysing the domain knowledge and enabling reuse of the domain knowledge (Noy & McGuinness, 2001, p. 1).

The properties that may reflect the solution for the VUSR knowledge representation are domain knowledge modelling and the unified communication that is involved with the ontology domain. As the conceptual models are representative of the real-world domains knowledge, in order to establish the domain knowledge models, ontology engineering is useful. Ontology can be employed to analyse the meaning of the conceptual models. From this point of view, the approach of ontology development sounds like a perfect solution for VUSR knowledge representation. In different fields, ontological representation of the domain has been employed to facilitate the communication between humans or computers. This is the result of the nature of ontology which comprises the vocabulary of basic terms and the specified meaning of terms.

According to the above discussion and existing definitions of the term ‘ontology’, a number of significant motives can be highlighted which show ontology development is crucial for the concept of VUSR including:

- ontology provides a common vocabulary of the area
- ontology defines the meaning of the terms associated with the area
- ontology, once developed, can be reused and shared and improved by others.

Considering the above, the researcher proposed ontology development, especially to define the social responsibility of VUs, to share common understandings of the area and to enable analysis and evaluation of the concept.

4.6. Ontology as a Solution for Building the Knowledge Domain for SR/USR/VUSR

In order to explore ontology as a part of the solution of this research, it is necessary to define the term at the early stage. The term 'ontology' has its roots in the field of philosophy where it refers to the subject of being or existence. In computer and information science, however, it is a technical term for a formal representation of the domain knowledge that is designed for a specific purpose and is aimed to enable the modelling of knowledge about some domain, real or imagined (Gruber, 2009). One of the first contributions in this regard defines 'ontology' as:

> ***the basic terms and relations comprising the vocabulary of a topic area as well as the rules for combining terms and relations to define extensions to the vocabulary*** (Neches et al., 1991, p. 40).

There are many different definitions for this term, and most define ontology as a formal explicit specification of a shared conceptualisation in which the formal specification refers to the concepts and their relationships (Gruber, 1993, p. 1). The term 'conceptualisation' in this definition points to an abstract model of how people think about things in the world that are restricted to a specific field. In some approaches, ontology has been referred to as being synonymous with conceptual model (Su & Ilebrekke, 2002).

Ontology has been considered to form the heart of any system of knowledge in a given domain as its associated analysis defines the structure of the domain knowledge (Chandrasekaran, Josephson & Benjamins, 1999). Considering ontology as an explicit specification of knowledge, it has a number of components including concepts (or classes), properties of each concept (its features and attributes) and relationships (or roles). Although different approaches to ontology definition have different perspectives and elaborations to these elements, these are the indispensable aspects of ontology development.

4.7. The Ontological Solution for the Research Problems in this Thesis

Figure 4.4 outlined the overview of the solution proposed in this research to address the research question. As the illustration shows, the overall solution comprises six sub-solutions:

1. solution for the concept definition of social responsibilities, i.e. ontology development for the concept of social responsibility in higher education
2. solution for the concept definition for virtual/online universities
3. solution for measuring the social responsibilities and USR/VUSR
4. solution for identification of the measurement metrics, indicators and attributes for performance in USR/VUSR
5. solution for definition of the fuzzy approach to obtain the overall figure of merit
6. the validation and verification of the proposed ontology and ontological approach for USR/VUSR measurement and knowledge sharing in the public domain.

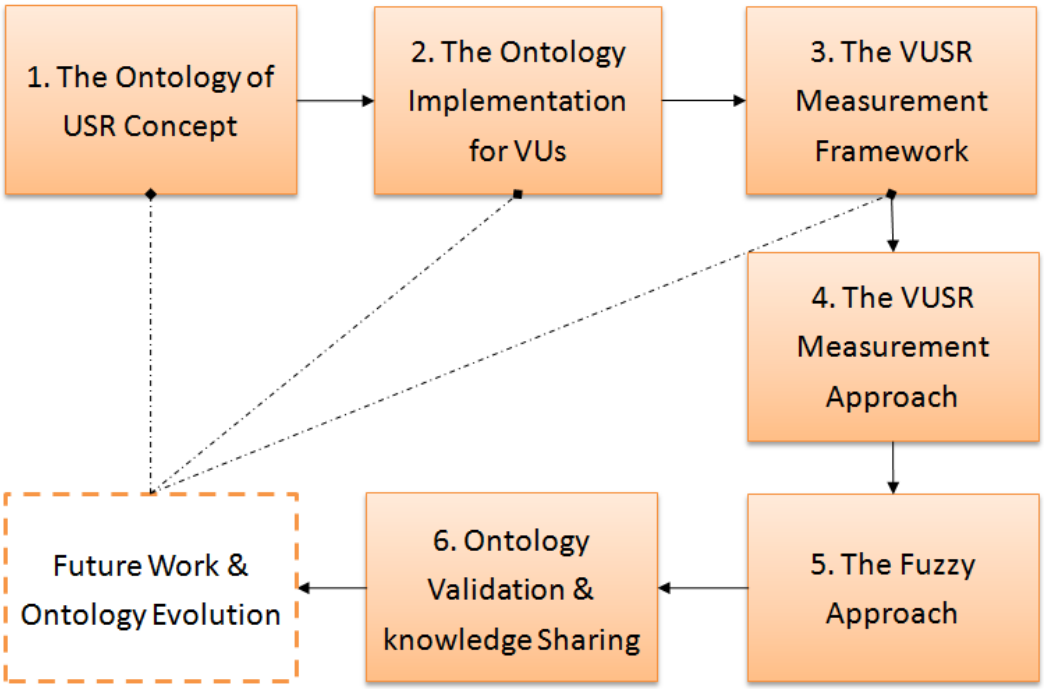


Figure 4-5 The overview of VUSR ontology and USR/VUSR measurement methodology

4.8. Ontological and Other Key Concepts Used in this Thesis

In each research approach, there are a number of terms which might be understood and interpreted differently by different people. Therefore, these terms need to be defined clearly by the researcher. In this chapter, some technical terms have been used to outline the research methodology and research approach. These terms in the context of this research have been defined in two categories, ontology-related terms and measurement-related terms.

4.8.1. Ontology-related Terms

The terms used to outline the solution overview for the concept definition and ontology development are defined as follows:

4.8.1.1 Ontology

In this thesis, the term 'ontology' refers to a comprehensive definition of the concept in which all concept components and their features are identified. This ontology, which brings up all the dimensions of the concept together, can be employed to outline the concept measurement framework.

4.8.1.2 Ontology refinement

In the proposed solution to address the shortcomings of the literature, ontology refinement refers to the final step of USR ontology development which is aimed to improve the output of the process. Specifically, ontology refinement here means to polish the developed ontology by merging the synonym terms and attaching the missing concept through examining the body of knowledge. The output of this process would be the comprehensive definition of the concept in which all concept elements and factors and their features are identified.

4.8.1.3 Ontology-based VUSR representation

Once the existing contributions for defining the concepts of USR and VUSR have been analysed, the comprehensive visual description of the VUSR concept will be proposed

accordingly. The proposed visualisation, which represents all the elements of the concept as well as sub-elements and their relationships in this research, is named the ontology-based VUSR representation. This representation can be employed to define the concept of and develop the measurement framework for VUSR.

4.8.1.4 Knowledge-sharing portal

The knowledge-sharing portal is one component of the VUSR portal which contains the formal representation knowledge of the domain, i.e. VUSR ontology. This portal is included in the VUSR portal to facilitate the dissemination of the created knowledge around the field.

4.8.2. Measurement-related Terms

There are a number of key terms used in the approach of this study and solution overview for VUSR measurement, such as VUSR components, indicators, performance attributes, measurement methodology, assessment framework, fuzzy-based approach and measurement methodology. These terms are defined below.

4.8.2.1 VUSR aspects

The VUSR aspects in this study refer to the elements on which the VUSR concept can be discussed and measured. For example, teaching–learning is the primary aspect of USR based on the concept benchmarked in the literature. Similarly, engagement is another USR aspect that has been quantified in the reviewed literature. Identification of all these aspects of VUSR is crucial for the purpose of this study, as they can be employed to develop the concept measurement criteria.

4.8.2.2 VUSR dimensions

The VUSR dimensions refer to the broad areas in which the concept's aspects will be defined and quantified. There are three main dimensions for the concept, including social, ethical and economic, which form the basis for discussion of the measurement criteria and sub-criteria in this thesis.

4.8.2.3 VUSR indicators

In order to clarify the VUSR aspects and make them quantifiable, there need to be indicators by which each VUSR aspect can be verified. In the other words, VUSR indicators in this research are the measures by which the researcher can evaluate each VUSR aspect. For example, the measures or indicators for teaching/learning can be quality of teaching, quality of learning, quality of online learning resources, quality and quantity of educating SD skills, etc. These indicators enable the researcher to develop the metrics for teaching–learning as the main VUSR factor.

4.8.2.4 VUSR performance attributes/sub-attributes

The VUSR performance attributes in VUSR metrics refer to the third level of VUSR components, which make the concept measureable. To clarify this notion, the same example from the previous section can be used. Considering teaching–learning as the main aspect of VUSR, and quality of online teaching as one of its indicators, the average grade of students' satisfaction of online teaching can be one of the performance attributes contributing to quantification of the concept. In this research, each performance attribute can be comprised of a number of sub-attributes.

4.8.2.5 VUSR measurement methodology

VUSR measurement methodology in this research refers to the overall framework that will be proposed to measure the VU commitment to social responsibility. This methodology includes the VUSR metrics (the assessment framework), the fuzzy-based mathematical techniques and the assessment approach (data collection techniques).

4.8.2.6 VUSR metrics/assessment framework

In the proposed measurement methodology, VUSR metrics point to the assessment tool that will be outlined based on the VUSR ontological representation and the concept definition. The metrics consists of a number of measurement scales which are customised for a variety of university performance indicators and their attributes in the social responsibility context. This tool can be employed to quantify online universities' commitment to social responsibility through their activities, products, policies and practices. Once the tool has been developed, it can be used to measure and compare

the performance of different online universities in regard to their social responsibility commitment, despite the variations between them.

4.8.2.7 Fuzzy-based approach

In the developed methodology, fuzzy-based approach refers to the specific mathematical methods that will be used to capture the uncertainty of human judgment in the evaluation process. This study aims to make use of fuzzy techniques in two stages. As the VUSR measurement criteria (fuzzy dimensions) have different levels of importance for quantification of the concept, this research will make use of a Fuzzy Analytic Network Process (FANP) to determine the degree of significance of each criterion. In this stage, the researcher will propose making use of the Triangular Fuzzy Numbers (TFN) for the computation and aggregation of overall VUSR score. In the second stage, fuzzy techniques will be proposed to analyse the collected data through the VUSR metrics. In order to calculate the final score of each fuzzy variable and the aggregated final VUSR score, it is proposed to make use of fuzzy values.

Fuzzy Dimensions: In the proposed VUSR metrics, fuzzy dimensions refer to the factors comprising the concept of social responsibility in the online university. These factors are assumed to be fuzzy because of the uncertainty involved with their definition and quantification.

Fuzzy Variables: Fuzzy variables in this approach represent the list of VUSR indicators by which the online university's commitment to social responsibility will be measured. In other words, these variables are sub-components of VUSR factors which facilitate the process of measurement and quantification of each factor. Fuzzy variables can also be used as the language for discussing the fuzzy dimensions.

Fuzzy Values: In the proposed metrics, a fuzzy value refers to a quantity whose value is uncertain, rather than exact. It is proposed to use these values for calculation of the assigned score to each fuzzy variable, as well as the aggregation of the final VUSR score.

4.8.2.8 VUSR measurement method

In this thesis, the VUSR measurement method refers to the data collection techniques. As the metrics by which the concept of VUSR will be measured are comprised of different sections and need to be filled by different university stakeholders, a variety of different measurement methods will be involved. Surveying university stakeholders and analysing the available documents are instances of these methods. The VUSR measurement approach also will clarify the scoring techniques corresponding to each method.

4.8.2.9 Prototype system

The prototype system in this research refers to the measurement methodology developed through scientific research which is put into practice for an iterative evaluation of the methodology as well as validation of its impacts.

4.8.2.10 VUSR portal/VUSR metrics portal

In this thesis, the VUSR portal refers to the web-based tool which presents the final output of this research through the prototype system. This portal is sometimes referred synonymously with the prototype system or VUSR metrics portal, and facilitates the use of the proposed framework and methodology for measuring VUSR in an automated manner. It also provides the knowledge-sharing portal for future improvements.

4.9. Choice of Ontology Design and Development Approaches

A variety of methodologies has been proposed and employed for ontology development in different fields, and specifically in the Artificial Intelligence (AI) field. The fundamental rule in this regard, as highlighted by Noy and McGuinness (2001), is that there is *no one correct way* to model the knowledge structure in a given domain and the ontology development approaches depend on their applications. There are many languages and a variety of commercial and open source tools for building and working with ontologies. These tools and languages have been surveyed by researchers

to assist people in different fields to choose the most suitable approach (e.g. Khondoker & Mueller, 2010; Su & Ilebrekke, 2002).

The starting point for ontology development could come from different origins. An ontology can be generated from scratch, from existing ontologies, from a corpus of information source, or a combination of the latter two approaches (Uschold, 2001). In regard to the process involved in ontology development, the methodologies can range from fully manual through to semi-automated to fully automated ontology building approaches (Ding & Foo, 2002). The following sections provide a brief introduction to these methods and then focus on the semi-automated approach for the USR ontology development of this research.

4.9.1. Manual Ontology Development Approaches (MOD)

The manual ontology development (MOD) approaches refer to the classic development techniques in which the generation of domain ontologies are entirely based on human participation. Omelayenko (2001), referring to the existing research and guidelines for manual ontology development, highlights that in this approach experts are required to develop the best knowledge acquisition process from their past experience and they need to pass through numerous case studies. The manual construction of ontologies on the one hand involves tremendous effort from experts, and on the other hand can result in some conflicts and mismatches. As Uschold (2001) stated that ontologies constructed manually are not only are time-consuming and labour-intensive, but are also subject to human error. Besides the drawbacks mentioned, these approaches usually cause a significant delay in updating processes. These ontologies do not effectively fit new applications' requirements, because the new applications require the possibility of managing an extensive quantity of data which humans cannot accomplish alone (Bedini & Nguyen, 2007).

4.9.2. Automated Ontology Development (AOD) Approaches

Since there are well-known and unsolved problems with the MOD approach, experts have highlighted the need for automated techniques for ontology construction and

management. It has been said that automated techniques can assist in achieving consistent and effective knowledge acquisition and integration in this field (Mima, Ananiadou, Nenadic & Tsujii, 2002). Bedini and Nguyen (2007), investigating the automatic ontology generation approaches, outline five crucial elements for each automated ontology development (AOD) process, including extraction, analysis, generation, validation and evolution. They attempted to define the AOD lifecycle through these five steps, which have been considered crucial for ontology generation from an existing corpus of data. This lifecycle is illustrated in Figure 4.8.

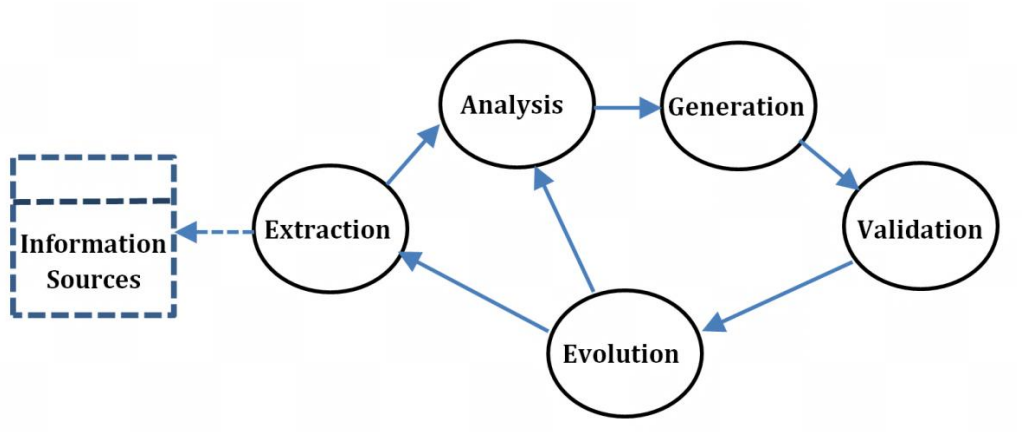


Figure 4-6 The automatic ontology generation process (Bedini & Nguyen, 2007, p.3)

It should be mentioned that the automated techniques can be unreasonably productive and inadequate at the same time. This means automatic generated ontologies on the one hand could obstruct a domain expert's correction. On the other hand, since these ontologies depend on seed words only, they could be inadequate (Riloff & Shepherd, 1999 cited in Ding & Foo, 2002).

Uschold (2001) categorises the automated techniques for ontology development into two categories: statistical techniques (e.g. clustering), and natural language techniques. Uschold believes that the fully automated approach is not appropriate for most situations, however, it can be a suitable choice for kick-starting a process as well as creating mapping rules. Human intervention is then required for the completion of the process.

4.9.3. Semi-Automated Ontology Development (SAOD) Approaches

The inadequacies of the two techniques above show a need to employ an approach which takes advantage of both manual and automated techniques and eliminates the issues involved in each technique. Pazienza and Stellato (2012) attempted to outline the state of the art in what is called semi-automatic ontology development (SAOD) techniques by publishing research results and resources aimed at the automation of ontology development processes. They have provided a thorough review of the current research on this subject and suggested common directions for researchers and practitioners who aim to develop ontologies.

As the benefits and drawbacks of manual or automated ontology development for a specific use are not clear for the potential ontology creator, a framework is required for methodology selection in which application-oriented decision criteria are included to support this process (Paslaru, Simperl & Tempich, 2006). In the current research, considering the limitations with two first approaches, a semi-automated approach has been proposed. Here, the ontology is limited to identification of the relevant concepts that represent the domain, and include the relationships between the concepts in order to group the relevant terms. However, the ontology can be developed using a standard language (such as W3C OWL) which will help to further improve the conceptualisation to cater for other scenarios.

4.10. Proposed SAOD Based Approach for USR Ontology Development

In this thesis, a novel ontology development approach is proposed for the knowledge domain of USR which is based on the SAOD approach (see Figure 4.9). A starting point for building the ontology seems to be one of difficulties for researchers in the process of ontology creation (Uschold, 2001), specifically in this research which does not have a strong background. Therefore, in order to identify the key elements of USR and the nature of the relationships between them with a view to engineering the first draft of the ontology, a content analysis and interactive approach is proposed.

The proposed methodology is a bottom-up SAOD approach which breaks down the process of development into four stages which involve both manual and automated tasks. I the manual tasks the researcher used scholarly databases for identification of the body of knowledge (St.1), eliminated unrelated words from word seeds, reviewing relationships to extract the key concepts (St.2) and refined the exercises (St.4). The automatic tasks comprised knowledge discovery (St.1), extracting the most frequent concepts and their associated terms (St.2) as well as their relationships from the corpus of data (St.3). The detailed information regarding the proposed approach and the output of its implementation will be represented in the next chapter.

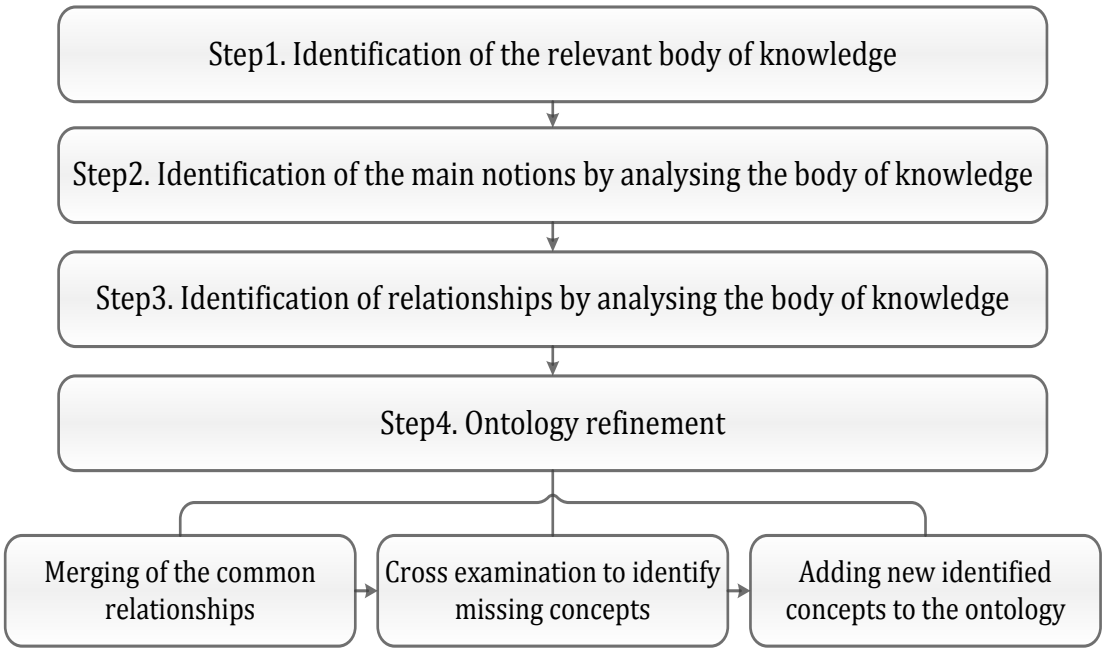


Figure 4-7 The proposed ontology development approach

4.11. Overview of the Conceptual Framework for the Solutions in this Thesis

This thesis will present three major parts of the solution in the following conceptual framework and its mapping chapters as follows:

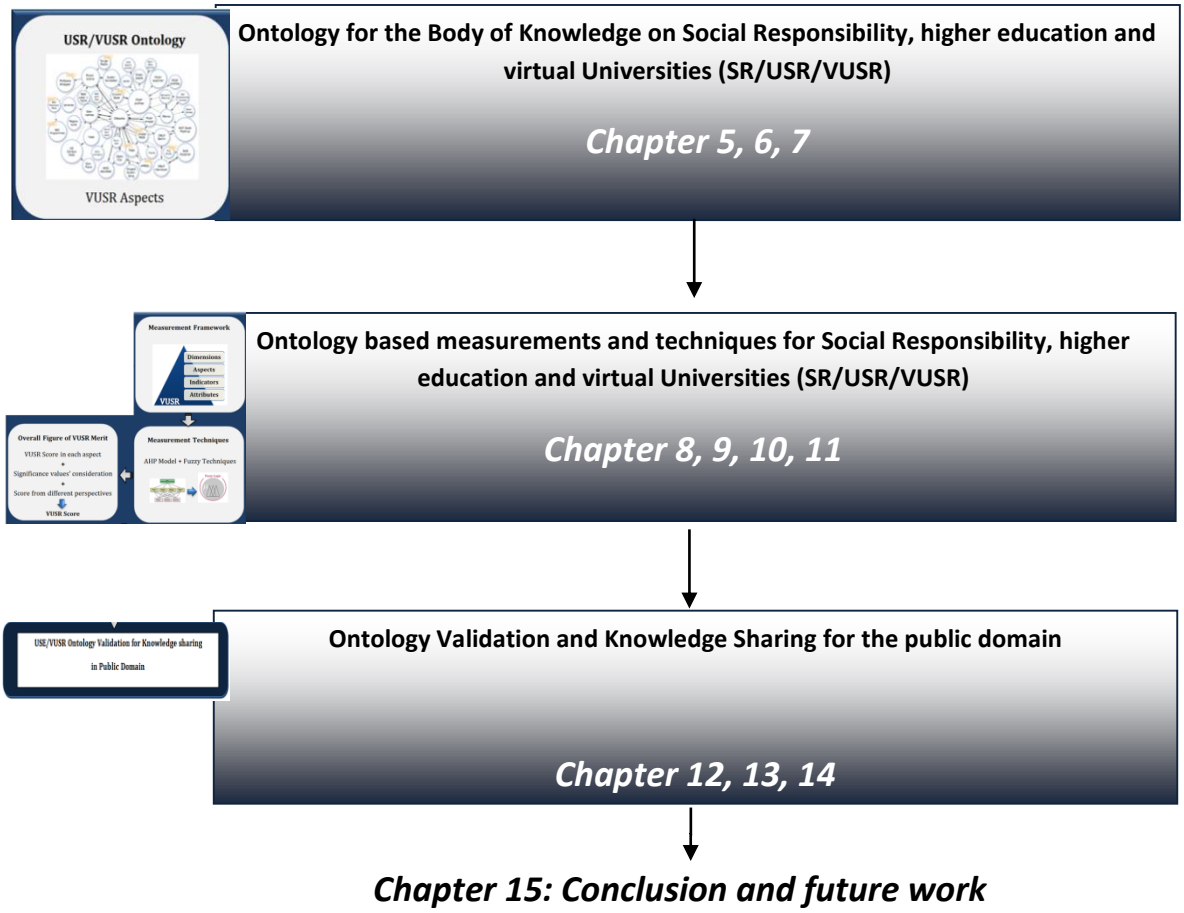


Figure 4-8 Overview of the Conceptual Framework

4.12. Conclusion

In this chapter, the first step of proposing the solution for the identified research problem has been taken. In this regard, a number of key concepts have been defined. Then a summary of the research issues and the possible solutions of this thesis have been presented. The researcher also discussed the approach to solution development and outlined the conceptual framework of the research. Then, the overall solution has been discussed briefly. It was followed by brief solution overview for each of the highlighted research issues in the previous chapter. The chapter also presented the reasons for choosing the ontology development as a fundamental part of the solution. Consequently, the ontology definition, choice of ontology development approach and the approach of this study in this regard have been discussed. In the next chapters, the detailed solution addressing each of the research issues will be provided.

Chapter 5_ Overview of the Ontologically Driven Solution

5.1. Introduction

In the previous chapter, it has been discussed that to address the lack of agreed knowledge regarding the USR concept, the solution can be developing the comprehensive formulization of the concept in which all the concept element and sub-elements have been clarified. In order to meet this requirement, the current available techniques and methods have been investigated. It has come to the researcher attention that the most appropriate technique which supports this is the use of a formal knowledge representation approach such as ontology. Therefore, the development of an ontology that represents the conceptual model of USR outlined in this chapter as the possible solution for defining the concept of social responsibility comprehensively and exclusively for higher education field.

This chapter begins with the formal definition of the context and concept related terms regarding virtual university social responsibility definition. This will be followed by discussion and demonstration of the overview of the ontology solution for USR in section 5.3. The proposed solution will be explained in six sub-sections. Section 5.4 presents the general understanding and definition of concept of university social responsibility based on the generated ontology and the last section will conclude the chapter.

5.2. Definition of Social Responsibility in the field of Virtual Education

Understanding the complication of a concept such as social responsibility is crucial in order to provide a ground for the later refinement and modification of the concept in

the different fields. The term ‘responsibility’ in general context means the state or trait of “being responsible; being accountable”. Researchers from different disciplines such as business, industry, and education have attempted to define the concept of social responsibility of an organization from different perspectives. However, there is no agreed definition across domains or even within the same field of study. It is worthwhile to note that having such a fitting definition to cover all the characteristics of the concept across different domains is unfeasible (Argandona & Hoivik, 2010). However, defining the concept of social responsibility in each domain is valuable and essential for measurement purposes.

In this thesis, in order to define and outline the concept of social responsibility of virtual university, a number of terms have been used. This section is aimed to define these terms in two broad categories including context definition terms and VUSR measurement associated terms.

5.2.1. Context Definition

In different chapters of this research, a number of terms have been employed to clarify the main concept of this research which is social responsibility. This notion has been referred sometimes as USR, and in most of cases it has been more specified as VUSR. The main context in which social responsibility has been discussed and investigated is virtual and online education setting. To clarify the meaning of each of these terms in the recent study, the following sections will defining them one by one.

5.2.1.1 Virtual Education

In this research, the virtual education considered synonymous term for online education. It refers to all sorts of educational opportunities in which public or private sector employs online technologies to facilitate teaching-learning experiences from distance for instructors and learners. In this sense, the Virtual University, Online University and Open University all refer to the same type of higher education institutions which operates completely online. In such a university, students, faculties, and administrators all can be located in different places and they communicate through

synchronous and asynchronous technologies such as email, discussion forums, video conferencing, etc.

5.2.1.2 Quality of Online/Virtual Education (QOVE)

Considering the quality of life improvement as the ultimate goal of VUSR, the quality of virtual education (QOVE) can be inferred as the main component in a socially responsible online university. As discussed in chapter two, because of its importance, there is a considerable amount of literature to define and quantify the QOVE. In this research, the QOVE term has been used to refer to the quality of online teaching/learning processes, quality of online course design and development, quality of learning materials, quality of support services (for students and faculties), quality of evaluation and assessment processes and all their associated sub-components. A socially responsible online university is expected to not only provide high quality education, but also to be concerned about the quality of its services through quality measurement and management practices.

5.2.1.3 Community Engagement

We define the concept of community engagement as the degree of partnerships between a university and its community (local and global) in a beneficial way for both parties. In this partnership, university attempts to serve the community beyond its obligations and also community, in a collaborative atmosphere, benefits the university and facilitates high quality education and experiential learning provision.

University Community: In this thesis, a university community defined as the current students; future students, academic staff, non-academic staff, students' and their families, alumni, schools, faculties and sub branches of the university. The university community directly associated with the university and receive the most impacts by the university performances.

Local Community: In the context of university social responsibility, the local community can be defined as the all citizens, the K-12 educational institutions, business institutions, industries, NGOs, other universities and colleges which are not

directly associated to a university, however they are located in the same neighbourhood with the university.

Global Community: The global community, in this research defined as the public, K-12 education, business, industries, other higher education institutions, and NGOs which are not located in the same neighbourhood with the university but might be affected with the university policies and activities.

5.2.1.4 University Stakeholders

As we defined stakeholders in this research, it refers to the university community, local community, global community, businesses, governments and society at large. In other words, it refers to all persons and groups who can be affected by the university policies and practices and also can have some impacts on the university performance and procedures.

5.2.1.5 Service/Outreach

Service/outreach is defined in this research as the collection of activities performed by a university for its stakeholders to achieve the goal of quality of life improvement. In this context, service activities have been differentiated from educational and research activities. Providing leisure and sport facilities for students, staff, the families, also facilitating public access to the university resources (e.g. libraries, galleries, etc.) are some instances of service or outreach activities.

5.2.1.6 Transparency

Transparency in the context of university social responsibility refers to a capacity by which university behaves open to its community. In this capacity, it is possible and clear for everyone to be aware of university policies, procedures and practices in teaching, research and service provision.

5.2.1.7 Ethical Dimension

In the context of social responsibility, ethical dimension refers to the aspect of university performance in which moral values such as the rule of law, equality, and respect for others have been considered. This ethical performance has to be integrated

into the university policies and procedures in all divisions of education, research and service provision.

5.2.2. Concept Definition

The Oxford Advanced Learner's Dictionary defined the term "legally or morally liable for carrying out a duty, for the care of something or somebody". Many Scholars acknowledge that social responsibility is a difficult concept to define. In the literature, terms such as 'intangible' and 'vague' are often used to refer the complexity of presenting an acceptable definition for this concept while considering its multidimensional construct (Vasilescu et al., 2010). This section defines two main associated terms to the concept of social responsibility in the context of this research.

5.2.1.1 University Social Responsibility (USR)

The university social responsibility term in this research refers to all types of university contributions to serve its community and its stakeholders beyond its obligations in its primary missions. The ultimate goal for this kind of contribution is to improve the quality of life of students, faculties, citizens, and society at large. Contribution to improving the employability of students, professional development of faculties, providing educational services to public, financial assistance provision for students, and so on are just some examples of university commitment to social responsibility. Although this concept is supposed to be beyond of rules and obligations; some of the USR factors such as providing high quality education associated with higher education goals and missions.

The concept of university social responsibility in this research is defined as a kind of university behaviour by which we will be able to signify the degree of the university contribution to improve the quality of life of its students, staff, their families, and society at large. This commitment can be conducted through providing high quality education, providing financial supports for disadvantage groups, providing special support services for disabled students, improving employability of graduates, service provision for public and non-student citizens, addressing community needs through research activities, engaging students with the real life experiences,

performing through an open and transparent operating system, and so forth. There are a number of terms which have been involved in the USR concept definition. For more clarifications, these terms will be defined here.

5.2.1.2 Virtual University Social Responsibility (VUSR)

Considering the definition of USR concept as proposed above, the outline of the VUSR concept is understandable. The virtual university is a new brand of higher education institutions which not only takes advantage of information and communication technologies, but also operates completely based on these tools. Although online/virtual university have different structure and operation system from conventional universities; the primary mission and its ultimate goal is to nurture skilled citizens and improve educational opportunities for all underserved people which is similar to traditional universities' mission in their societies. Bearing in mind this common theme, it can be mentioned that the concept of USR is applicable for virtual universities with some modifications in university practices regarding social responsibility.

Hence, the concept of VUSR can be defined as all sorts of online university contributions to improve the quality of life of online learners, online faculties, their families, community and society at large. Similarly, some examples of a socially responsible virtual university can be as follows: developing the employability of online graduates, contribution to graduates work placements, providing professional development for online faculties, providing educational programs with public concerns, promoting faculties and students to engage with the community beyond their classroom, commitment into high quality online/virtual education, etc.

5.3. Overview of the Ontology Solution for USR

5.3.1 Solution Part 1 _ Ontology Concept for USR

In order to define the concept of social responsibility in the field of tertiary education, the broad solution in this research is to develop the comprehensive

formulization of the concept in which all the concept element and sub-elements have been clarified i.e. USR ontology. To achieve this, the literature of the field needs to be reviewed and the existing contributions for the concept definition need to be identified. These contributions can assist researcher to represent the existing body of knowledge regarding the concept of social responsibility in the higher education field. In this representation, the main factors and indicators by which the concept has been defined and discussed will be extracted. Using the identified concept factors and indicators the ontology of the concept, i.e. the comprehensive definition will be developed. The next chapter of the thesis will outline comprehensive formalization of the concept using the notation system as shown the table below. The sub-components of the USR ontology also will be defined in the next chapter. Figure 5.1 shows the upper level of the USR ontology which will be presented in detail view for the proof of concept in Chapter 12.

Table 5-1 The ontology notations

Ontology Notation	Semantics of Notation
	Oval with blue circle represents nodes (Concepts)
	Double arrow represents inter relationships
	Upward and downward solid arrows respectively represent parent and children relationships
	Line represents the association relationships

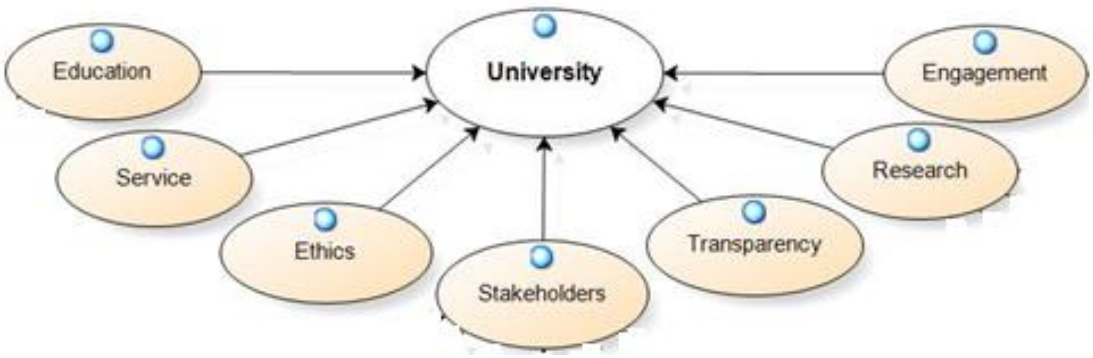


Figure 5-1 The USR ontology (Proof of Concept see Chapter 12)

5.3.2 Solution Part 2 _ Ontology for VUSR

Considering the differences between virtual university and conventional university, it can be inferred that the USR ontology needs some modifications to be appropriate for online education settings. To give an example, the higher education missions in these two settings can be referred.

According the existing knowledge, one of the important components of USR is research activities through which higher education institutions are expected to contribute to their society improvement. However, for online university this component is not as visible as traditional universities while considering their missions and practices. There are a few online universities in which the research or discovery mission is as considerable as their teaching mission. Therefore, this USR component and its importance in online education setting need to be modified.

The quality of education is another component of social responsibility measurement in higher education setting. This component also has different dimensions in different forms of universities. It is necessary to explore the quality dimensions for virtual universities as an important component for VUSR. In order to do this, the broad solution which is proposed in this research is to conduct another literature review for USR components in the field of online/virtual education to see how they have been defined and discussed.

This literature review can be carried out along with questioning experts' opinion in the field of online education regarding USR components applicability for online university setting. The output of this stage would be the modified USR ontology which is applicable for online universities. This modified version of USR ontology is called the ontology-based virtual university social responsibility representation. The Chapter 7 will represent details regarding implementation of the USR ontology for the online university context.

5.3.3 Solution Part 3 _ Ontology based VUSR Measurement

Once the ontology-based VUSR representation has been developed in which the VUSR aspects and sub-factors are outlined, it can be employed to develop the metrics for measuring the concept. In this measurement framework, each VUSR aspect is measureable through its indicators. Figure 5.2 demonstrates the measurement indicators for each VUSR aspect. As can be seen the VUSR indicators mostly have qualitative nature, so to make them more understandable the researcher needs to establish the performance attributes for them.

Therefore, the VUSR measurement framework comprises of a number of measurements the concept aspects as the measurement criteria, their indicators as the sub-criteria and the corresponding performance attributes for each indicator. Figure 5.3 demonstrates an example of measurement framework configuration for the VUSR aspects. As the figure shows, based on the different levels of the ontological representation of the VUSR concept, different elements of the measurement outline have been configured. In this configuration, each VUSR aspect comprises of its indicators and each indicator breaks down into its attributes and sub-attributes to clarify what exactly needs to be measured.

The third level in this framework, i.e. performance attributes can form a list of questions regarding the university performance in each VUSR dimension which will be answered by university stakeholders in a quantitative manner. The concept of USR/VUSR is defined to be the university contribution to improve the quality of life of a variety of stakeholders, hence in this metrics different university stakeholders have to be considered. All details regarding the VUSR measurement framework and the components of it will be discussed in Chapter 8 and Chapter 9.

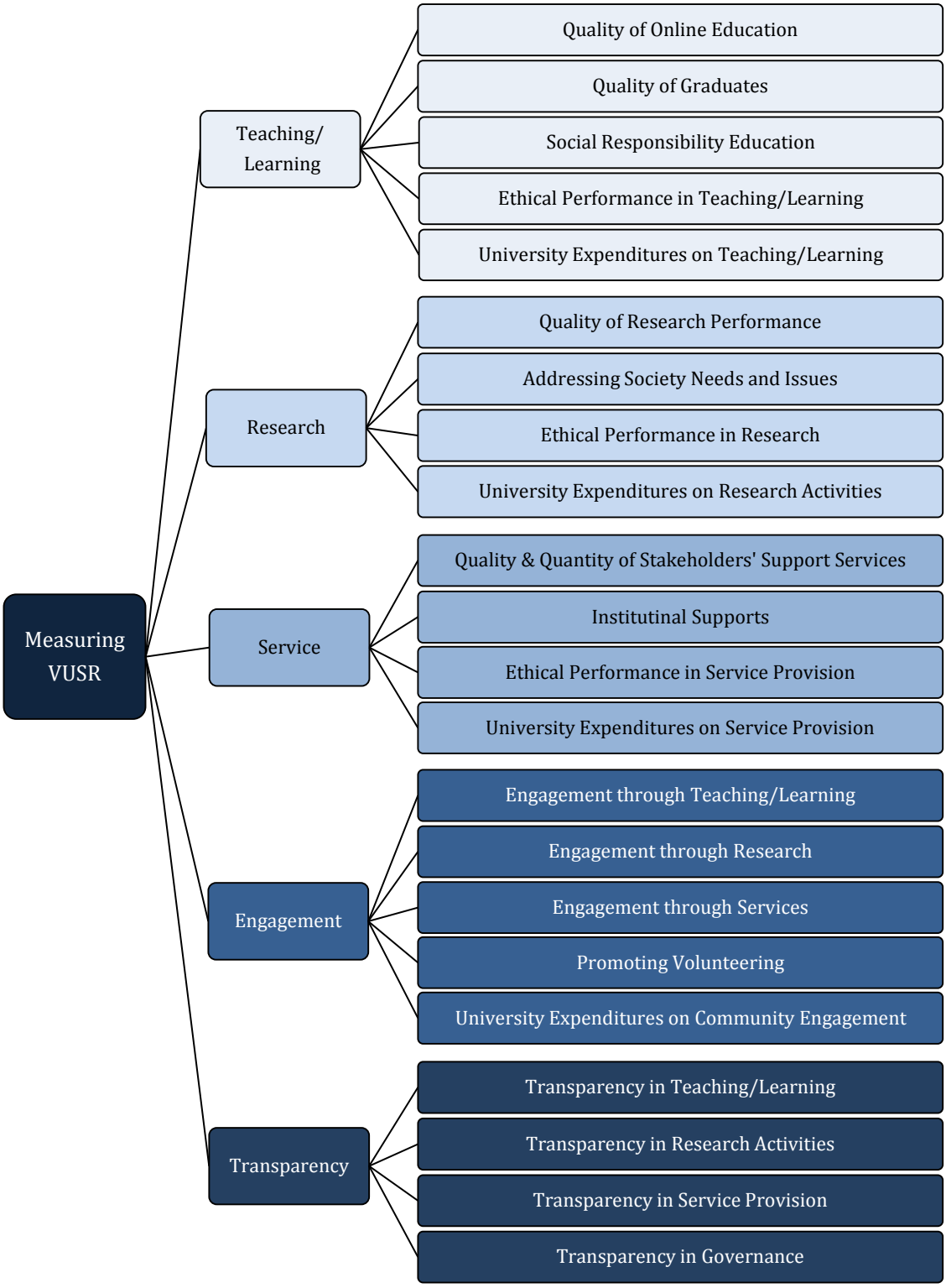


Figure 5-2 The overview of VUSR Ontology based measurement

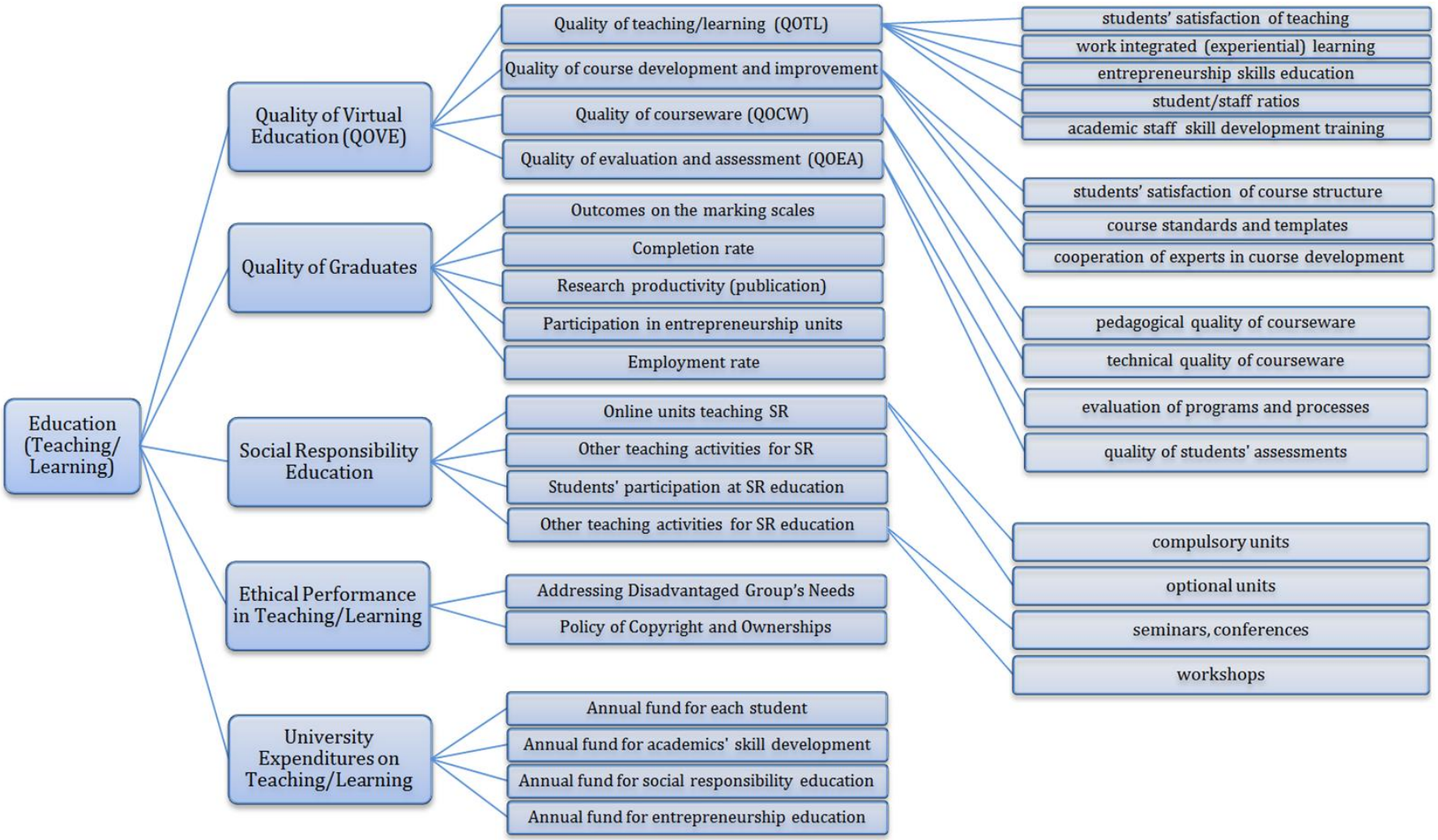


Figure 5-3 Ontology and Sub-Ontology Concepts for Teaching/Learning aspect of the VUSR measurement

5.3.4 Solution Part 4 _ The AHP based VUSR Measurement

The measurement approach which refers to the data collection techniques, in this research will be outlined, considering the existing paradigms in the literature. As mentioned in previous chapter, most of the contributions to social responsibility measurement are limited to using a single data collection technique which results in insufficient data. This research will make use of a holistic measurement tool which employs hybrid measurement techniques and considers not only what universities publish regarding their resources, activities and outputs, but also the stakeholders perceptions of the university commitment to social responsibility. In this hybrid measurement approach, different methods for data collection will be combined to ensure the accuracy and reliability of data from different perspectives. The employed measurement approach and methods can incorporate different perspectives regarding social responsibility of virtual universities in the process of its quantification. This approach can takes advantage of analysing the university records as well as surveying university staff and students as the primary stakeholders.

In this thesis, one of the approaches that has been proposed for data analyses is the AHP approach. As the concept of social responsibility and the judgements associated with its measurement are relative, the researcher proposes to make use of an AHP relative measurement approach in which the assessment criteria will be pairwise compared. In this technique the assumption is that there are a number of universities which their commitment to VUSR will be assessed and compared at the same time. The Chapter 10 of this thesis will outline the VUSR measurement approach using AHP technique in details.

5.3.5 Solution Part 5 _ Fuzzy-based VUSR Evaluation

As discussed earlier, the concept which this research is aimed to define and to quantify is a fuzzy concept. Therefore, it is essential in its measurement methodology, to incorporate fuzzy techniques to capture the uncertainty which is woven to the concept and the human judgements correspondingly. To achieve this, it will be proposed to make use of fuzzy approach in different stages of the quantification process. In the initial phase, the researcher adapt the fuzzy the extent analysis method which is

proposed by Chang (Chang, 1996) and has been employed by many other researchers recently such as Hussain, Sangka, and Hussain (2012) and Yuksel and Dagdeviren (2010). This technique will be employed to identify the criteria significant value of each VUSR measurement criteria (i.e. VUSR factors). The fuzzy approach in this research also will outline how to define the membership functions for each measurement criteria as well as the aggregation mechanism. In Chapter 11, the solution for incorporating fuzzy techniques in the VUSR measurement methodology will be outlined in details.

5.3.6 Solution Part 6 _ Ontology Validation and Knowledge Sharing in the Public Domain

In this thesis, in order to validate the proposed ontology framework and measurement methodologies, the researcher will make use of data and text mining approaches, couple with statistical methods, to drive the body of knowledge for Social Responsibility and USR/VUSR. A shared knowledge portal based on the extracted body of knowledge of VUSR also will be provided. This will be achieved employing the Hozo tool which is a specialised ontology builder in a distributed environment. Therefore, a prototype system will include the ontology or the body of knowledge for Social Responsibility and especially for USR and VUSR will be presented. In order to achieve this, chapter 12 will proved details for the proof of concept regarding the developed ontology and its verification. Then, the prototype system will demonstrate the measuring the social responsibility of a given virtual university through an on-line survey form. The system will help all on-line education and any virtual universities to quantify their commitment to social responsibility. The prototype system shall comprise of different phases to involve different stakeholders and use variety of input for a comprehensive measurement. In Chapter 13, the overview of prototype system will be outlined. The chapter 14 of this thesis also is dedicated to provide more details regarding the system components and the simulation experiment, the web-based metrics and the knowledge sharing portal.

5.4. The Ontology-Based USR Definition

By engineering USR ontology, this research contributed to conceptualize the notion of university social responsibility. The developed ontology is the first ontological manifestation of USR and its associated terms in the existing literature. It is critical that the developed ontology reflected a shared or global conceptualization of the concept. Although in the literature different terms have been used to define and describe the concept of USR, it can be inferred the social responsibility of a university can be seen through its partnership with its stakeholders and community in different levels (see Figure 5.4)

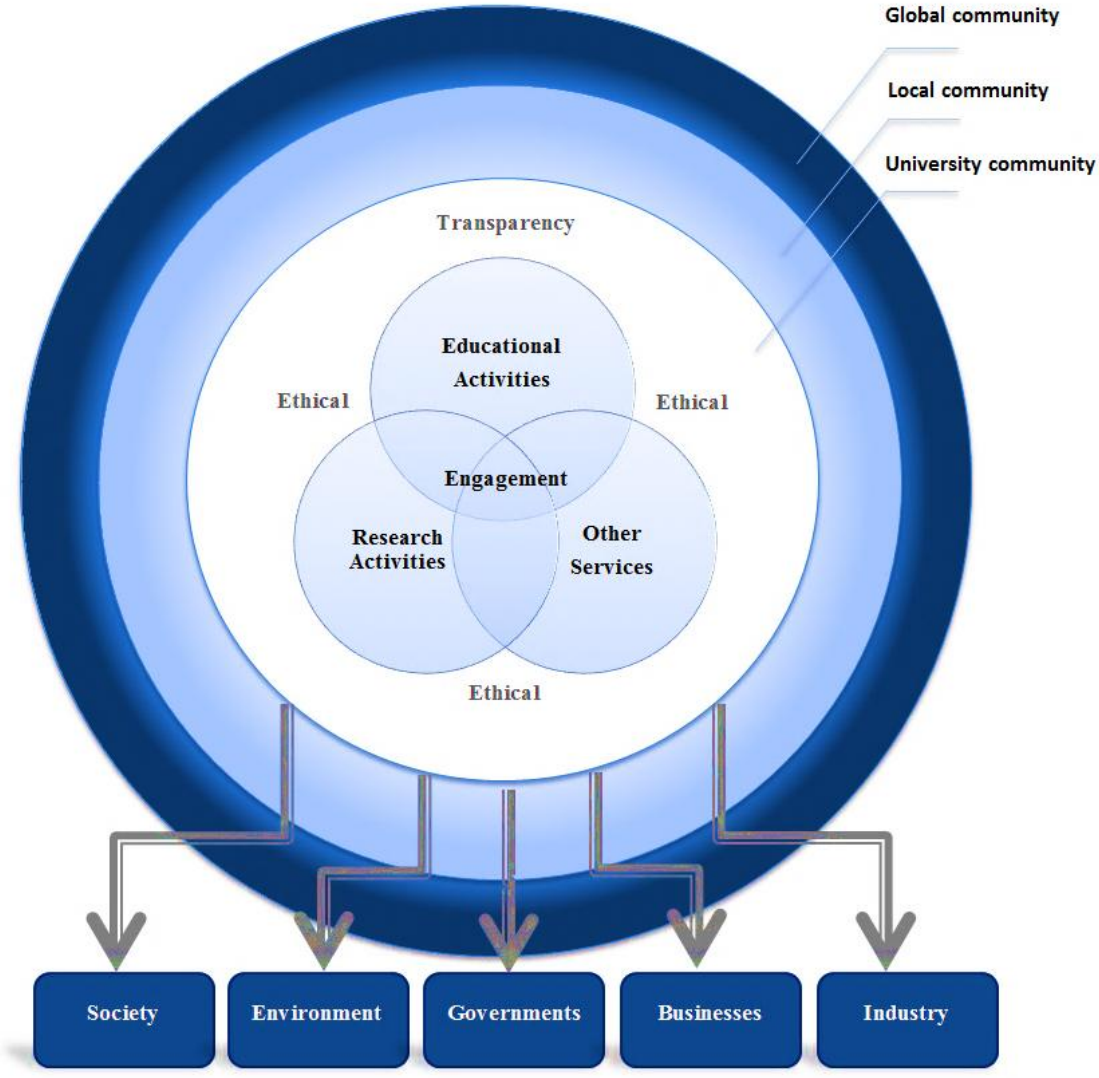


Figure 5-4 The university social responsibility framework

As the USR framework outlined (Figure 5.4), a socially responsible university engages with the communities through its functions which are education, research and service provision. Two other important components through which main functions should be performed are ethics and transparency. This ethical and transparent engagement can be appeared during the university process, products and the outcomes. It is therefore sensible to define the concept of USR as *a concept whereby university integrates all of its functions and activities with the society needs through active engagement with its communities in an ethical and transparent manner which aimed to meet all stakeholders' expectations*.

What the USR ontology, in this research, highlighted as the most important component of USR is stakeholder. That means a socially responsible university crucially should consider all stakeholders encompassing society, business, communities, environment, government, and industries. According the research findings it can be mentioned that the main stakeholder whom universities should consider is community which has different levels including campus community, regional community and global community. In a socially responsible university, there is a continuing commitment to address community problems through knowledge production, nurturing active and engaged citizens, contributing to social change, considering moral values, high quality service provision which finally results in a sustainable development.

5.5. Conclusion

This chapter was aimed to develop a comprehensive formalization of the concept of social responsibility in the university context in which all the concept elements and sub-elements have been clarified. In order to ensure this, the chapter started with the formal definition of the context and concept related terms and then a bottom-up semi-automated ontology development approach has been proposed and articulated. For the proposed approach four steps have been discussed in details and the output of each step have been represented. The general understanding of the concept of university social responsibility based on the developed ontology has been defined at the final

section of this chapter. The developed USR ontology outlined seven sub-concepts and their related notions for the USR definition. These sub-concepts will be defined in the next chapter.

Chapter 6_ The Ontology and Sub-Ontology for University Social Responsibility (USR)

6.1. Introduction

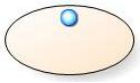
According to the developed ontology for USR, there are seven main notions associated with USR defined and discussed through the literature. Each of these notions can indicate different meanings; therefore definitions based on the USR context are required. Section 6.2 defines the approach the researcher uses to develop the sub-ontologies and the following sections present the sub-ontologies and definitions of the seven sub-concepts of USR. Then, the chapter will be concluded.

6.2. The Ontology Notation System Used in this Thesis

The notation system found in Chapter 5 is employed to demonstrate the knowledge representation of the concept. According the notation system (Table 6.1):

- an oval with a blue circle represents concepts from the initial corpus (SR context)
- an oval without blue circles represent concepts from the online university literature;
- Upward and downward solid arrows respectively represent parent and children relationships; and
- Line represents the association relationships

Table 6-1The ontology notation, copied from Chapter 5

Ontology Notation	Semantics of Notation
	Oval with blue circle represents concepts from the initial corpus (SR context)
	Oval without blue circles represents concepts from the online university literature regarding each sub-concept
	Upward and downward solid arrows respectively represent parent and children relationships
	Line represents the association relationships

6.3. The Upper Ontology for University Social Responsibility

Figure 6.1 presents an overview of the proposed ontology for USR. The upper ontology for the concepts of USR consists of seven key concepts as shown in Figure 6.1 including:

1) Education
2) Research
3) Engagement (industry etc.)
4) Services (community outreach etc.)
5) Ethics
6) Transparency
7) Stakeholders

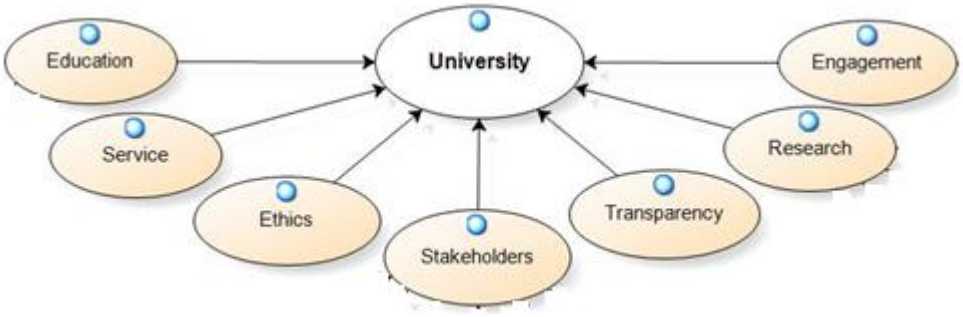


Figure 6-1 Upper-ontological concepts for USR

6.4. The Sub-ontology of University Social Responsibility

Figure 6.2 presents a high-level view of some sub-ontological concepts. This chapter will present a detailed ontology and its sub-ontology for USR.

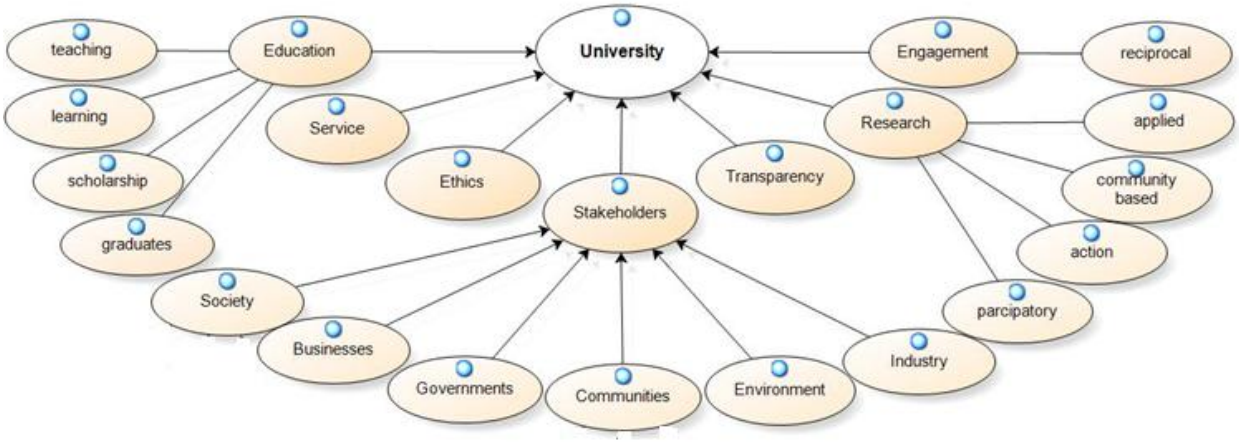


Figure 6-2 Sub-ontology representation

In order to define the sub-concepts of the USR ontology, the researcher first considered the general meaning of each sub-concept found in the highly referenced dictionaries. The researcher also employed WordNet® which is a lexicon database for general meanings of each term. Proof of the ontology design is shown in Chapter 12.

In order to grasp the specific meaning of the sub-concepts, the corpus of texts which compiled from the literature for the ontology generation were analysed in the Leximancer environment. In this software, the application of word queries were run for all these words using the corpus of data to find how each notion is defined or referred to in the USR context. The word query can search the given words to find its co-occurrence with other words, and exports all phrases where the specified words appeared. In the following sections each notion of the USR ontology will be defined based on these analyses.

6.5. The Sub-ontology of Education/Teaching/Learning

The general meaning of the notion of 'education' constitutes the process of receiving instruction; the process of acquiring or transferring knowledge; and the knowledge that has been acquired by the process of teaching and learning. Based on the word query analysis, it was revealed that besides its general meaning in this context the notion of education is characterised by features such as 'continuing', 'high quality', 'accessible' and 'relevant to the community needs'. The term is also associated with some other terms such as 'lifelong learning', 'active citizenship', 'service-learning', 'mobilised programs', 'sustainable development' (SD), and 'economic and social needs'. In the analysed literature, teaching SD skills to new generations has been discussed as one of the crucial responsibilities of universities to their societies. Figure 6.3 illustrates the visual representation of sub-ontology of education in the context of social responsibility.

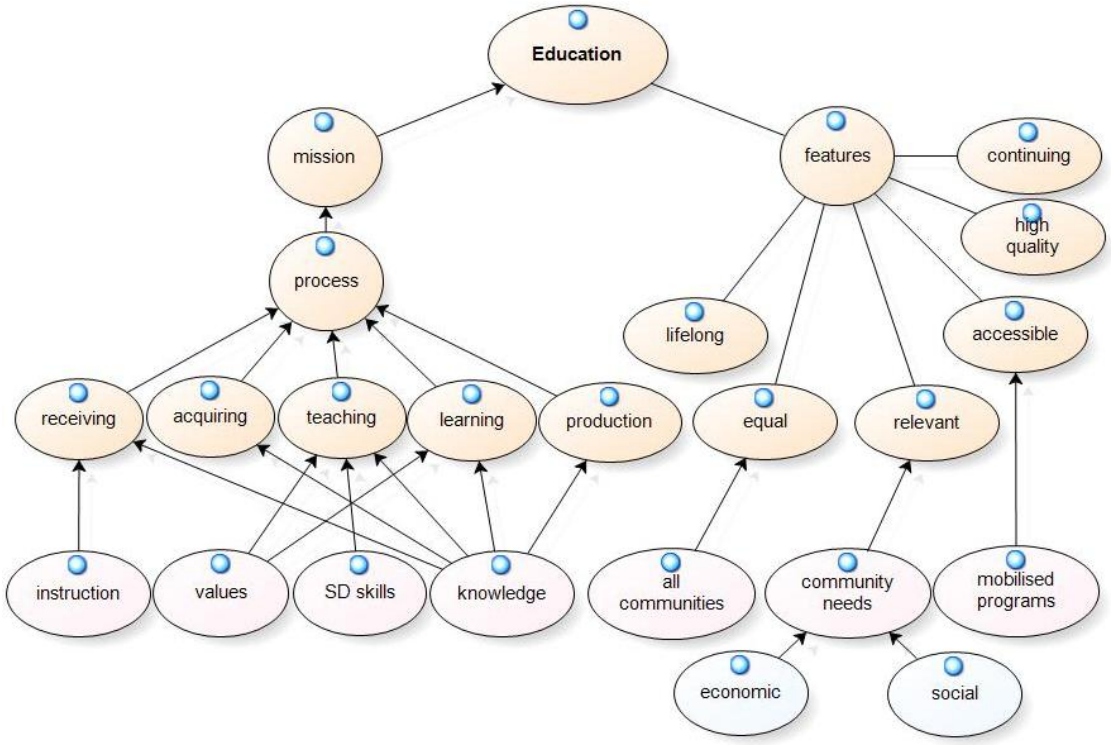


Figure 6-3The sub-ontology of 'education'

According to the sub-ontology of education, this concept in the USR context can be defined as *a high-quality and continuing process of nurturing active and engaged citizenship which is aimed to address economic and social needs of its community*

through lifelong service-learning and mobilised programs. Lifelong learning can be defined as the continuous process of acquiring knowledge, skills and values throughout the life of an individual, through experiences which encountered formally or informally in the course of a lifetime ("Lifelong learning," 2011). Service-learning (experimental learning) here refers to the combination of structured learning opportunities with action in the communities which can result in a stronger and enhanced educational experience (Guthrie & McCracken, 2010). In this kind of education students might have the opportunity to spend a part of the course volunteering in a wide range of community activities. A socially responsible university is expected to consider accessibility of its educational programs for all students and under-served population of its community and 'mobilised programs' in the definition of education here refers to such a consideration.

6.6. The Sub-ontology of Research/Discovery

'Research' as one of the main functions of a university has been discussed and described in depth in the USR literature. Generally, it can be defined as a systematic process of investigation where, using scientific methods, a researcher identifies a problem and subsequently tries to solve it and establish novel ideas, facts or theories. This is done with a view to further push the frontiers of knowledge in that discipline. As can be seen in the visualisation of sub-ontology research (Figure 6.4), there are two notions very closely related to the term 'research', i.e. 'discovery' and 'PAR'. The term 'discovery' is synonymous or even the preferred word for 'research' in the USR context. This notion in the corpus is characterised by features such as 'entrepreneurial', 'problem-centred', 'multidisciplinary', 'interdisciplinary', 'community-based', 'disciplined' and 'action-oriented'. In the analysed literature, the most referenced research methods for community development are action research and PAR. In most cases, these two terms have been used interchangeably (Barker, 2004), however in some cases they have been specified as different methods of community-based research (Couto, 2000). PAR, in the *International Encyclopaedia of Human Geography*, is broadly defined as the research by, with, and for people affected by a particular problem, which takes place in collaboration with academic researchers (Kindon, Pain & Kesby, 2009).

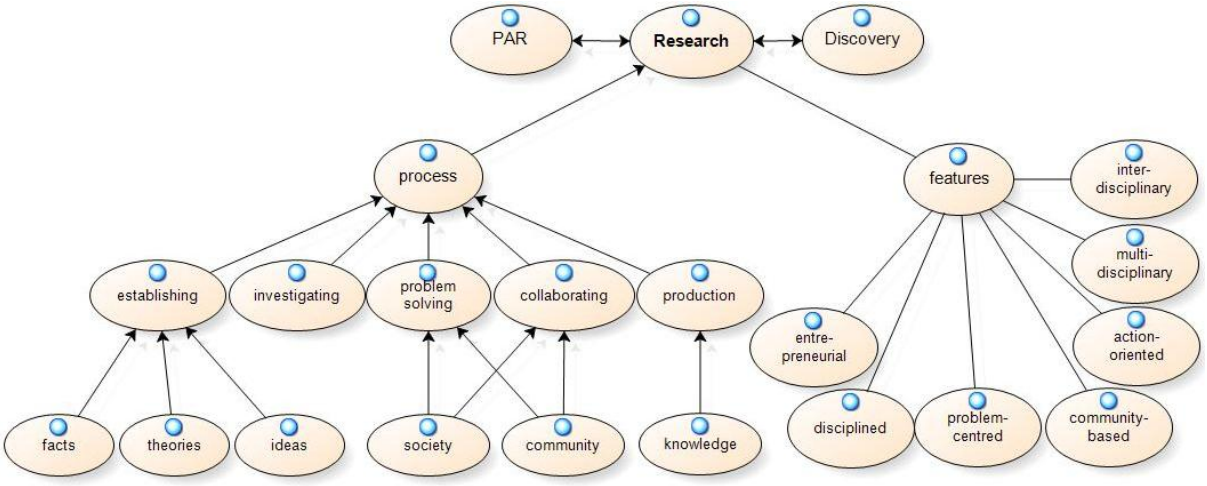


Figure 6-4 The sub-ontology of 'research'

It should be mentioned that the notion of PAR impacts the holistic meaning of research in the USR context, because the majority of scholars who define university missions (teaching, research and service) refer to it as a preferred strategy. This notion is also implicit in the proposed definition of the research in this project. The notion of research here has been defined as *a kind of scholarly activity which is aimed at knowledge production and social change through collaboration between academic experts and community participants to address community problems*.

6.7. The Sub-ontology of Engagement

Scholars have used the word 'engagement' as a key concept referring to social responsibilities of higher education institutions. One of the widely used meanings of this word is the act of sharing and being involved in the activities of a group. Because of the key role of this concept in the USR domain, there are many contributions throughout the literature to define it, however, there is no consensus. The word 'engagement' in this context is mostly used synonymously with 'partnership' and represents 'collaboration', 'dialogue' or interaction between a university and its communities. Sometimes it constitutes a third university mission, i.e. service or outreach (Farrar & Taylor, 2009; Hall, 2009). In some references, it is defined as a 'mechanism', 'process', 'means' or 'strategy' by which a university commits in a partnership with society. The characteristics of engagement in the USR domain are defined as 'experimental', 'argumentative', 'reciprocal', 'collaborative', 'thoughtful',

and so on. The vocabulary for this concept in the literature is depicted in the illustration below (Figure 6.5).

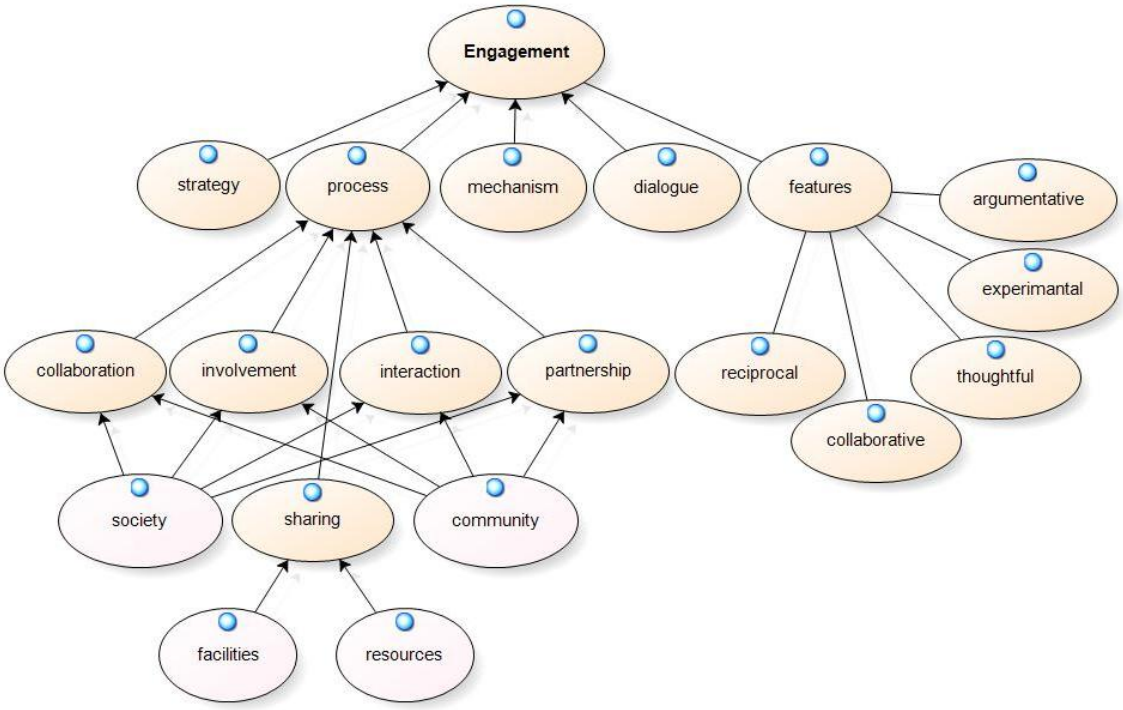


Figure 6-5 The sub-ontology of 'engagement'

Using the above information, the proposed definition of the engagement concept here is *a reciprocal and beneficial interaction between university and its communities that is developed based on shared goals through which university and community resources come together to link university activities such as teaching, research and service to the wider society needs*. University resources are comprised of a variety of human and non-human resources, such as experts, employees, learners, instructional environments, educational programs, training, libraries, galleries, labs and other facilities where the process of education can be conducted. The community resources in this sense consist of practitioners, citizens, organisations, public funds, etc.

6.8. The Sub-ontology of Service/Outreach

The general meaning of 'service' is the work done by one person or group that benefits another person or group (WordNet®). In the higher education field it can broadly

represent what universities provide for their stakeholders. Therefore in its general understanding, service can cover all university missions such as education, research and other service provisions. A review of the literature reveals that the notion of service is one of the most challenging concepts to define precisely, because its interpretation and use in the literature is fuzzy. This concept, similar to other notions of USR, is interpreted differently in the higher education context by different scholars.

To find the exact meaning of this concept in the scope of USR, the researcher ran word queries on the corpus of the existing literature, and the results disclosed that the most co-occurred words were 'teaching', 'research', and 'engagement'. In some cases, this word is used interchangeably with 'outreach' or even 'engagement' (Farrar & Taylor, 2009; Hall, 2009) and in some others, its identification overlaps with 'education' and 'research' (Abdullah, 2006; Soutar & McNeil, 1996). This complexity is perhaps due to the nature of a university mission which can be considered as different types of service, although service by itself is represented as one of the trinity of university functions throughout the literature.

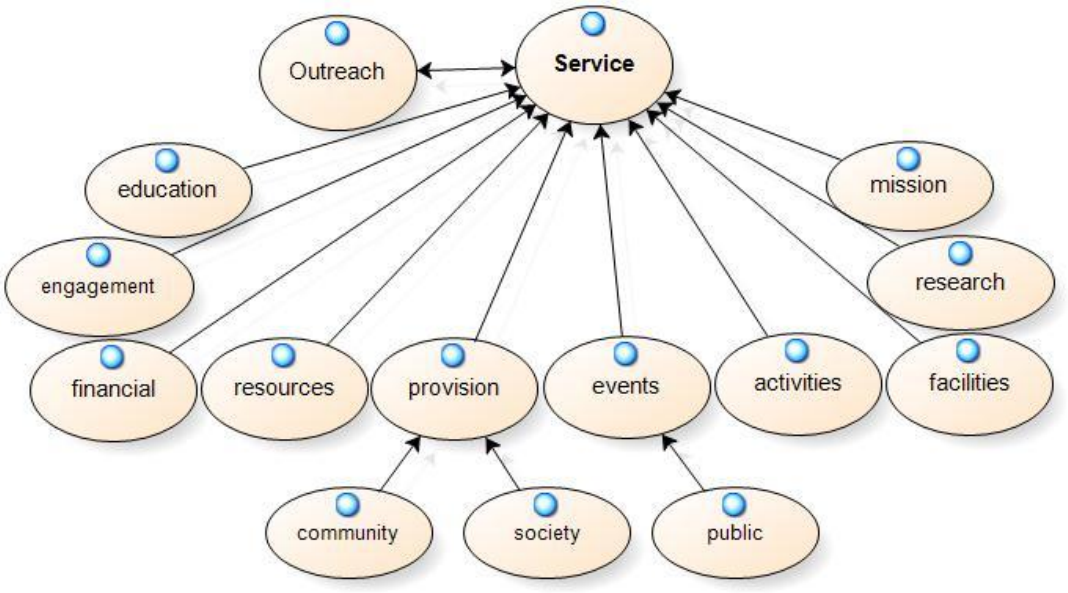


Figure 6-6 The sub-ontology of 'service'

In the corpus of the texts there are other terms that appear to be close to the notion of service, including provision, activities, facilities, events and resources (see Figure 6.6). In this research 'service' has been differentiated from t other university missions in the USR context and has been defined as *all sorts of facilities which a university, apart from its research and educational functions, provides for its*

stakeholders including (but not limited to) health care services, technology accessibility, promotion plans, cultural programs, public events, galleries, museums, library resources, conferences and workshops with public concerns, sport facilities, financial supports (grants, scholarships and awards), volunteering and charity services, and so on. Some of these facilities can serve university students and staff and their families, however, others can be beneficial for all parts of society at large.

6.9. The Sub-ontology of Ethics/Ethical

The word 'ethics' is mainly defined in a general context as the standards and rules by which human's behaviours can be governed (WordNet®). It is also known as a discipline and a branch of philosophy where the standards of conduct be studied. It should be noted that ethics gives us a scale for judgment of what is acceptable performance. This subjective notion in the literature emerged as one of the main factors of USR. This word appears mostly alongside terms such as 'standards', 'approach', 'behaviour' and 'responsibility'. Although Barrow (2006), in his essay about a coherent concept of academic ethics, differentiated the word of morality from ethics, the term 'moral' is used synonymously in the literature. Scholars in their identification and interpretation of the USR concept usually state that universities must be ethical in their performance, they must follow and maintain moral standards (Arnzten, 2009; Ramaley, 2005; Reiser, 2007), however they usually did not try to clarify what is the ethical performance or standard. Ethics is also referred to as a means of ensuring universities have proper decision-making in their processes (Moore, 2009) or a value by which they strengthen their operations (Weingartner, 1999). Tetrevova and Sabolova (2010) identified three ethical levels of USR, corruption disclaimer, intellectual property protection and code of ethics.

Noteworthy for this research is the notion that ethics is not like university missions (education, research and service provision). In fact, in a socially responsible higher education institution, it is woven throughout the policies, procedures and applications in ways that make it difficult to be defined. In the corpus of texts 'ethics' and 'ethical' have both been used to refer to the same dimension of USR. Therefore,

here the word ‘ethical’ is used because it describes the most important dimension of USR. Figure 6.7 shows the representation of the sub-ontology of ethics/ethical from the corpus of literature.

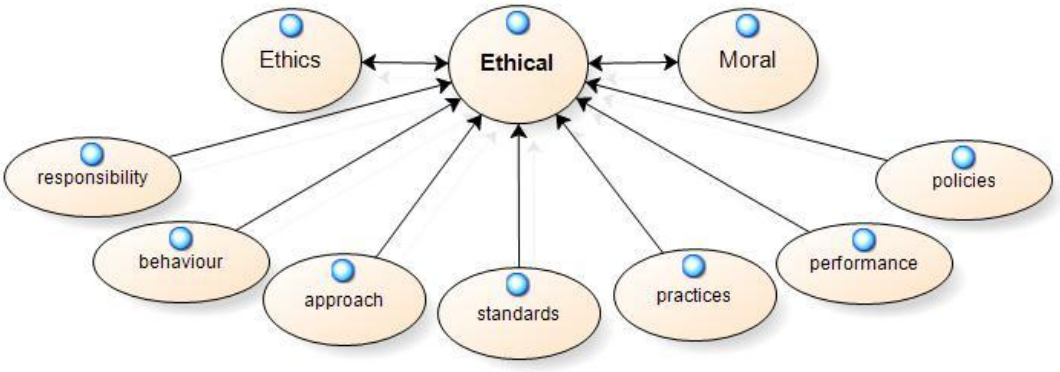


Figure 6-7 The sub-ontology of ‘ethics/ethical’

In this research, therefore, the ethical dimension of USR has been defined as *the consideration of moral values such as the rule of law, equality, respect for others, and all other values that underpin sustainable development through university policies and procedures in all divisions of education, research and service provision*. In this sense, for example, university administrators establishing performance-monitoring systems are concerned to follow rules in their procedure and conduct. The ethical aspects of education on the one hand can deal with nurturing ethical values, such as social responsibility, respect for others, tolerance, etc. On the other hand, it can be considered as equal education opportunities for all community members regardless of their age, gender, race, financial capability, etc. Similarly, in a socially responsible university, research projects and policies aim to address all sorts of community needs considering ethical issues that are integrated in the process and respect for intellectual property. In service provision, a university should also attempt to serve the public, especially disadvantaged groups of the community through charities, volunteering activities, providing equal opportunity in the workplace and other types of support. SD in our proposed definition refers to a better quality of life for present and future generations (Ciegis, Ramanauskiene, & Martinkus, 2009).

6.10. The Sub-ontology of Transparency

'Transparency' is generally is defined as *operating in such a way that it is easy for others to see what actions are performed* (Transparency, 2011) and is often used synonymously with 'accountability' and 'openness'. As mentioned before, it is the neglected factor of USR in the analysed literature, therefore word queries cannot provide clear information about the definition of this concept in USR context. It appears in the corpus of data four times, two of which are side by side with 'accountability' (Sawasdikosol, 2009; Vasilescu et al., 2010).

In another case it is referred to as one of the principles that underlie university community engagement (Farrar & Taylor, 2009). As there was not enough evidence to clarify the concept, the word was searched through the academic literature. This investigation revealed that 'transparency' has been used mostly in business and political settings as one of the critical characteristics of administrative bodies and governments. In this context it is used to refer to different notions, such as countering corruption, openness in decision-making or even good governance in policies and programs (Ball, 2009).

Transparency International, a non-profit organisation, defines the concept in a general context which sounds applicable for USR ontology with some modifications. The definition has been revised for the purpose of this research as follows: *Transparency in a socially responsible university refers to the criterion that allows university stakeholders who can be influenced by administrative decisions to know not only about the basic facts and figures, but also to be informed of the procedures and policies.* It is the duty of university executives and directors to have visible, understandable and predictable conduct. It can be achieved in higher education through freedom of information, publishing performance results and participation of stakeholders in formulation and implementation of university policies. Transparency on the one hand can result in a higher quality education, research and service provision, and on the other hand make it possible for citizens to have a qualified choice among different higher education institutions.

6.11. The Sub-ontology of Stakeholders

According to the *Oxford English Dictionary*, 'stakeholder' in general refers to a person or group who has an interest or concern in an organisation and might be affected by its operations. Each enterprise has relationships with a variety of individuals and groups which can be affected by its policies and procedures or affect its performance; these individuals and groups are the enterprise's 'stakeholders'. In the USR literature, 'stakeholder' appears alongside most often with words such as 'community', 'students', 'staff', 'institutions', 'citizens', 'environment', 'governments', 'business', 'society, etc. In this context 'community' is usually referred to as synonymous with 'stakeholders'. Word query analysis revealed that the community was identified as the main stakeholder for universities; society, environment, governments, businesses and industry respectively are other important stakeholders for a higher education institution. Different scholars define university stakeholders in different categories. For instance, primary (students, teachers, administrators) and secondary (parents, alumni, business sector, etc.) stakeholders (Sawasdikosol, 2009). Almost all contributors concurred on the fundamental stakeholders of a university (as mentioned above), however some of them added other interest groups as key stakeholders. For example, some scholars also referred to NGOs or graduates as major stakeholders (Hill, 2005; Vasilescu et al., 2010). In the literature, the most comprehensive identification of university stakeholders was presented by Tetrevova and Sabolova (2010), which included course applicants, students, graduates, staff, grant agencies, sponsors, suppliers, other educational institutions, ministries of education, governments, public authorities, businesses and the public. Figure 6.8 represents a visualisation of sub-ontology of stakeholders based on the analysed text.

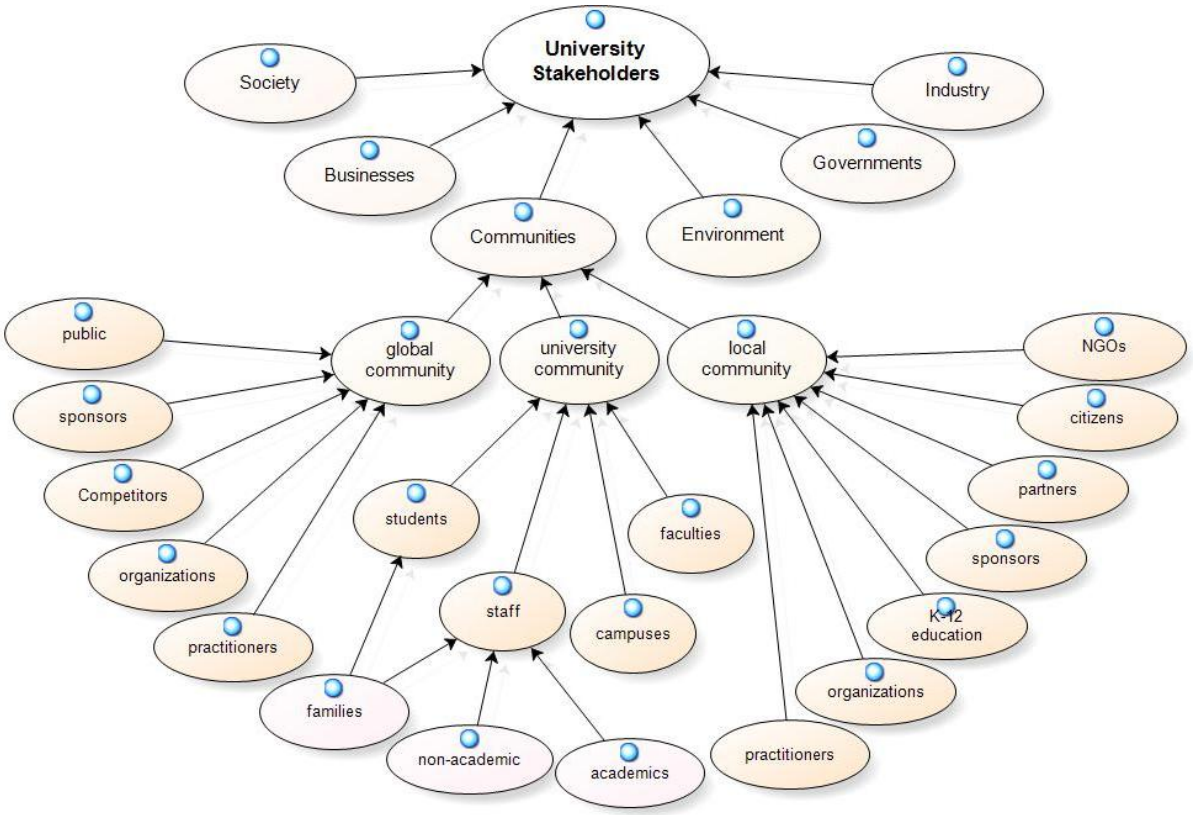


Figure 6-8 The sub-ontology of 'stakeholders'

From the point of view of USR ontology, university stakeholders can be defined as *all of those who can take advantage from or are affected by university actions or have an influence on its operations including university communities, society, environment, governments (regional, local, central), businesses and industries. Community as the main stakeholder includes the university community (current students, future students, alumni, academic and non-academic staff, administrators and their families), local community (citizens, practitioners, partners, K-12 education institutions, NGOs and other institutions, regional sponsors, grant agencies, suppliers, etc.) and global community (public, competitors, international sponsors, and so on).*

6.12. Conclusion

In order to define the sub-concepts of USR and develop the sub-ontologies, the researcher defined the approach early in this chapter. Then, based on this approach, the concepts ‘education’ including teaching and learning notions, ‘engagement’, ‘research/discovery’, ‘service/outreach’, ‘ethics/ethical’, ‘transparency’ and ‘stakeholders’ were defined and the sub-ontologies of these concept were visualised. In the following chapter, the proposed definition and the generated ontologies will be employed to specify the USR ontology in the context of virtual and online universities.

Chapter 7_ The Ontology for Virtual University Social Responsibility (VUSR-Ontology)

7.1. Introduction

In the previous chapters, in order to address the absence of agreed knowledge regarding the concept of USR, a comprehensive formulation of the concept, namely USR ontology and its sub-ontologies, has been generated based on the existing body of knowledge. This chapter aims to modify the developed ontology to be applicable for virtual/online university social responsibility (VUSR-Ontology) measurement. To achieve this, the USR ontology will be reviewed considering its main aspects in the literature of online education to modify the sub-notions in the field.

In this chapter, section 7.2 will discuss the specification of the ontology-based VUSR aspects. The modification of the education (teaching/learning) aspect of the VUSR-Ontology will be discussed in section 7.3 and will be followed by specification of the engagement aspect in section 7.4, the research aspect in section 7.5 and the service provision aspect in section 7.6. Three other aspects, ethics, transparency and stakeholders, will also be modified and represented in sections 7.7, 7.8 and 7.9 respectively. The next section will outline the ontology-based VUSR representation and then the chapter will be concluded.

7.2. The Key Concepts Inherited from the Ontology of USR

As online and virtual universities have specific features, metrics development for measuring their social responsibility needs to take into account the proposed USR

ontology alongside its specifications in virtual education. This means the constructed USR ontology needs to be specified according to an online university's features. In regard to its nature, the virtual university and conventional university are both considered higher education institutions where teaching and learning opportunities can be provided to people who want to acquire a tertiary degree. As universities, they both provide services for their stakeholders and facilitate teaching, learning and research activities for them. Because of the common functions of these two higher education systems, extracted sub-concepts from the USR concept, which represent higher education missions, can be applicable for VUSR as well. However, because of differences in virtual and conventional universities' operational systems, the notions and attributes for each system should be specified. Hence, after a thorough review of the online and virtual education literature, the proposed USR ontology will be revised in this chapter. The notions for each sub-concept have been developed according to the online education literature. In this revision, the indicators by which each component can be quantified were also extracted.

According to the findings in previous chapters, the main components which define a given university's commitment to social responsibility include education (teaching/learning), research activities, service provision, community engagement, transparency in policies and practices and ethical conduct. These components have been investigated to find out how they have been referenced in the context of the online university and social responsibility. The existing contributions have been reviewed to extract their sub-notions for ontology refinement as well as metrics development. The following sections outline the sub-notions for social responsibility components in online education settings based on the reviewed literature, including documents in Google Scholar.

7.3. Overview of VUSR Ontology

The above-mentioned discussions have been considered to illustrate the final representation of the concept of VUSR for measurement purposes (see Figure 7.1). As the figure shows, there are different levels of concepts associated to the VUSR

concept. In this visualisation, the first level of nodes except the stakeholders' node represents the components of social responsibility that have been extracted from the literature of this concept in the higher education setting (i.e. education, research, service provision, engagement, transparency and the ethical dimension). The second level of nodes shows the sub-notions of the VUSR components which in some cases can be referred to as the measurement criteria for VUSR components (such as quality of graduates). The third level represents the associated nodes which can be considered the sub-criteria in the process of quantification of the VUSR concept. The notation of the ontology-based VUSR representation is the same system as shown in previous chapters (seeTable 5.1).

Considering all the USR sub-concepts' specifications, the concept of VUSR has been outlined in Figure 7.1 where the aspects of USR have been illustrated alongside their sub-notions in a VU context. As can be seen, the literature analyses in the online university context resulted in no changes in the first level of the ontological representation of the concept. The second level contains minor revisions; however the third level of the concept is almost completely changed considering the context specification.

According to the ontology-based representation of the VUSR, this concept can be defined as all kinds of VU contributions to improve the quality of life of online learners, online faculties, their families, the community and society at large. The examples of VUSR commitment include but are not limited to developing the employability of online graduates, contribution to graduates' work placements, providing professional development for online faculties, providing educational programs of public concern, promoting faculties and students to engage with the community beyond their classroom, commitment into high QOVE, etc.

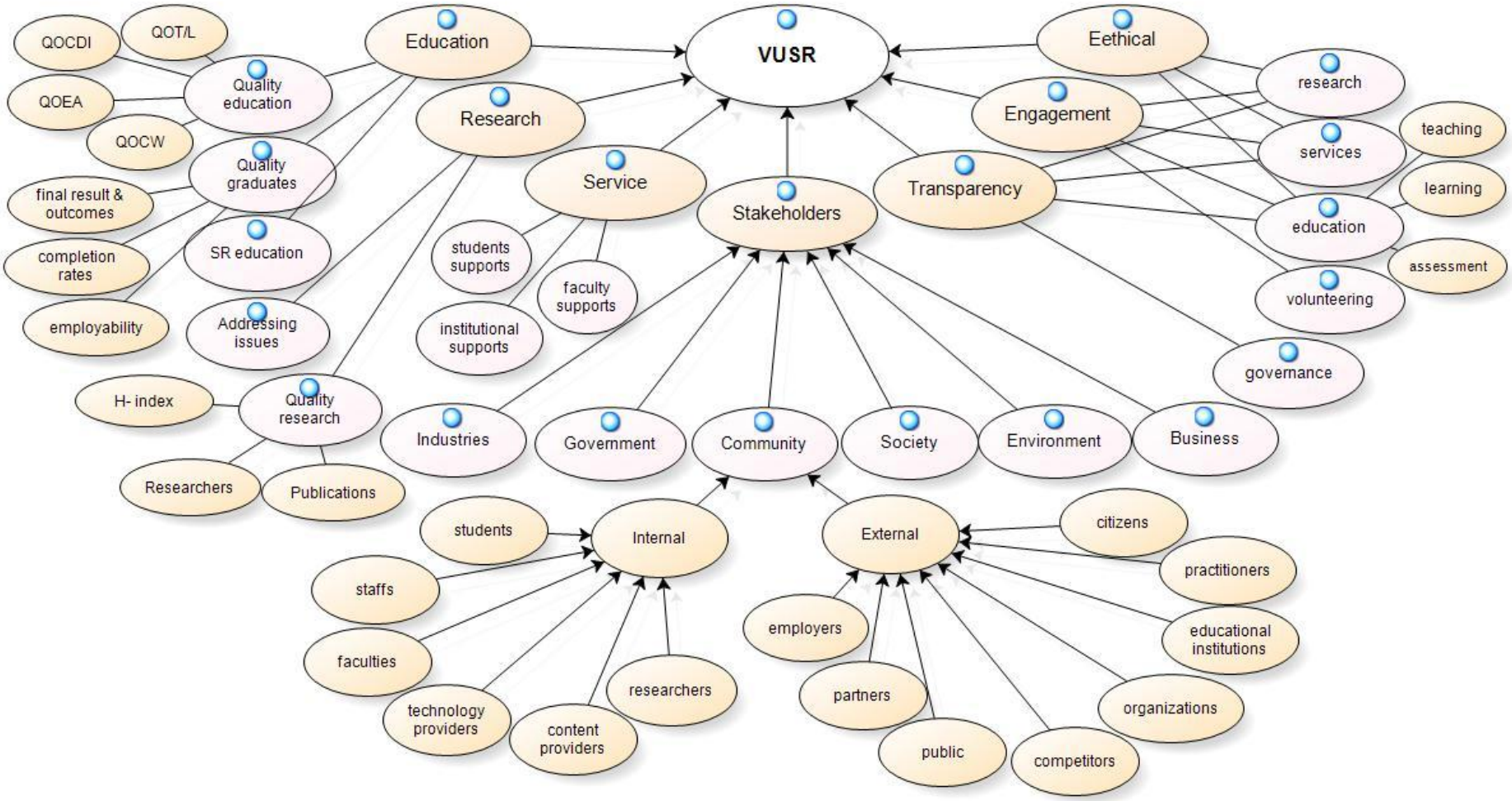


Figure 7-1 The ontology-based VUSR representation

In the next few sections, the seven key VUSR-Ontology concepts in the concept of the VU environment are illustrated, namely:

1) Education
2) Research
3) Engagement (industry etc.)
4) Services (community outreach etc.)
5) Ethics
6) Transparency
7) Stakeholders.

7.4. VUSR Ontology – Education (Teaching/Learning)

According to the USR ontology, education, including the sub-notions of teaching, learning and scholarship, is one of the most important components defining higher education institutions' commitment to social responsibility in the literature. Its characteristics referred to in the analysed literature are continuing, lifelong, accessible (through mobilised programs), equal, relevant and high-quality. It is not surprising that the first three characteristics point to online education features, because this literature has been recognised in online education as a strategy for social responsibility in educational access (Stewart, 2004). The creation of equal educational opportunities for all community members, as well as provision of high-quality education relevant to community needs are other common features of the educational mission of online and traditional universities. In this view, the first component of social responsibility can be considered similar for both contexts; however it is important to extract the specific indicators from the online education literature for measurement purposes.

As mentioned in the previous chapters, providing high-quality education has been found to be one of the most referenced responsibilities of higher education institutions to their stakeholders and societies at large. There is an extensive literature defining and discussing the measurement approaches for this sub-notion of USR and VUSR. A simple search in Google Scholar revealed 592 documents containing the

exact phrase ‘quality of online education’ and 31 documents including the ‘quality of virtual education’ phrase. The results of search queries were reviewed for the purpose of this research to extract the sub-notions for QOVE as a VUSR component. In order to carry out a thorough review across the body of knowledge, 85 scholarly documents were selected which contributed to define or measure the QOVE. The output of this thorough review was a number of sub-notions for the concept of QOVE, including quality of online teaching/learning (QOTL), quality of online course development and improvements (QOCDI), quality of courseware in technical and pedagogical aspects (QOCW), as well as quality of evaluation and assessments (QOEA).

Considering the USR ontology, it can be seen that ‘graduates’ appeared as one of the sub-notions of education. In the analysed USR literature, commitment to improving the quality of graduates and their employability has been referred to as a responsibility of universities to their students, employers, industries and society. The two phrases, i.e. ‘quality of graduates’ and ‘employability of graduates’ have been searched in the context of online education. The Google Scholar search query resulted in 56 documents for the first phrase and 49 for the second one, 22 of which directly discussed the quality of graduates. A thorough review of these documents revealed that terms such as ‘alumni rates’, ‘final grades and outcomes’, ‘publications’ and ‘employment status’ are associated with the notion of the quality of graduates. Therefore, these terms can be considered as the sub-notions for this factor in the VUSR representation.

In the USR ontology, teaching social responsibility has also been identified as one of the sub-notions of education. As online universities are also responsible for nurturing good citizens and socially responsible graduates, this sub-notion can similarly be considered for the ontology-based VUSR representation.

7.5. VUSR Ontology – Research Activities

While the major mission and stronger focus of VUs has been identified as their teaching and learning aspect (Cornford & Pollock, 2005), there are some online

universities where the main mission is defined as research. What Nikolov (2009) named University 2.0 is an example of this stream. Considering examples of online research universities, and VUs providing research-based courses in the same way that the conventional universities do, the researcher has accepted the same sub-notions defined for the USR ontology to be employed for the ontology-based VUSR representation.

7.6. VUSR Ontology – Service Provision

In contrast to the previous component (research), the mission of service provision cannot be considered similar in online and traditional universities. The reason is in the nature of this mission in these two types of higher education institutions. Obviously, service provision in a virtual environment has its own requirements, policies and appearance. In order to specify this sub-notion in the online university setting, key terms such as 'service provision' and 'outreach activities' were searched in the literature of the online/virtual university. The results contained 131 documents published in Google Scholar, most of which were not relevant. After reviewing the search query results, six documents were selected where service provision in online universities was discussed clearly.

In the USR context, service provision and outreach activities have been discussed as a university's contribution to serve all its communities (including university and local communities). However, in the online education setting, service provision has mostly been discussed in regard to the university's internal community, i.e. online students and faculties. An in-depth review of the selected documents revealed the notions associated with the component of service provision and can be considered as indicators for this notion, including terms such as 'student supports', 'faculty supports' and institutional supports.

7.7. VUSR Ontology – Engagement

In the context of USR, engagement has been outlined as a partnership between the university and its communities with a special focus on the local community and industries. In this setting, engagement has been reckoned as a strategy to involve students and academic and non-academic staff in activities outside the classroom which benefit society. A thorough review of 27 documents out of 128 documents found in Google Scholar containing the key terms 'online/virtual university' and 'engagement' reveals that the term 'engagement' in the online university context has mostly been used to refer to internal community (i.e. student and staff) collaborations.

In the online education field, engagement has been identified as one of the key aspects of higher education. The first and most referenced dimension of engagement in this field defines the concept through students' and faculties' interaction which results in the development of a responsive learning environment (Betts, 2008; Coates, 2006; Collins & Watts, 2009). The second most referenced dimension of engagement is highlighted as the university partnership with wider society through involving student with the local and global community partners. This second aspect aims to engage online learners with the real world of work and to make connections between learning, application and experience, even at a distance, to benefit both students and their communities (Odom-Bartel & Wright, 2012; Shirley & Cockburn, 2009; Soria & Weiner, 2013). Finally, the third dimension traced in the literature refers to engagement as a crucial process which enables online learners, instructors and other VU stakeholders to participate in institutional conversations about education (Coates, 2006).

As can be seen, all these dimensions of engagement refer to the university's partnership with its communities through its main functions of teaching, research and services. Another aspect of university community engagement is volunteering, which shows that although the engagement happens through the university's mission, some aspects of this collaboration are voluntary. In discussions of the factor of engagement in the online university setting, terms such as 'education', 'teaching', 'learning', 'service', and 'volunteering' can be identified as the sub-notions for this concept.

7.8. VUSR Ontology – Ethics/Ethical

In order to arrive at a clear understanding of notions related to the component of ethics/ethical in the online university context, the key terms 'ethics OR ethical OR moral' plus 'online university' OR 'virtual university' were searched in Google Scholar. Among the hundreds of scholarly works containing the key words, there were five contributions which focused directly on the ethical aspect of online universities. These documents have been reviewed for the purpose of this research.

The review results show that the factor of ethics has been considered in two broad directions, namely 'ethical issues' and 'ethical standards' in the field of online education. The first direction points to the ethical problems which VUs need to address, such as plagiarism, personal data disclosure and ownership matters (Brey, 2004; Nnaji, 2012; Wang & Heffernan, 2009). In the second dimension, ethical standards and behaviours in teaching, learning, service provision and research have been discussed (Brey, 2006; Rose & Adams, 2005). Considering this literature, it can be inferred that the ethical aspect of online education can be pursued through university missions. Therefore, the sub-notions by which the ethical aspects of the VU can be identified and quantified are 'education' (teaching-learning), 'research' and 'service'.

7.9. VUSR Ontology – Transparency

The term 'transparency', similar to other social responsibility components, has been searched in the context of the online university. Although the search results show hundreds of scholarly works containing the key word 'transparency' plus 'online/virtual university', reviewing the results revealed just two journal papers dedicated to investigating this notion in the field of online education (Dalsgaard & Paulsen, 2009; Mackey, 2011), and some other contributions referred to the concept briefly as an indicator for quality in online education (Agariya & Singh, 2012; Burbles, 2013; Palmer & Holt, 2009; Reimann, Bull, Halb, & Johnson, 2011). These

contributions have been reviewed thoroughly to extract the sub-notions of transparency in the online university context.

Reviewing the corpus reveals that, like other contexts, in online education the term ‘transparency’ has also been used to emphasise the importance of university openness in its processes, mechanisms, resources and services. The aspects of online education transparency that are highlighted include quality assurance mechanisms (Hope, 2001), online services (Dalsgaard & Paulsen, 2009), university governance (Saxton & Guo, 2009) and educational processes such as teaching (Mackey, 2011), pedagogic decision-making (Reimann et al., 2011), students’ assessments (Agariya & Singh, 2012; Palmer & Holt, 2009) and finally teachers’ evaluation (Burbules, 2013).

7.10. VUSR Ontology – Stakeholders

A search in Google Scholar shows there is much research in the field of online education in which stakeholders have taken different points of view. Further consideration of the contributions shows that VU stakeholders affected by the VU’s operation have been defined in a similar manner to traditional universities. These can include industries, businesses, communities, environment and government. The community in this context contains online students, faculties, administrators, educational institutions, content providers, technology providers, accreditation bodies, alumni, employers and communities (Collins & Watts, 2009; Wagner, Hassanein, & Head, 2008). In regard to importance, online students have been referred to as the central stakeholders of VUs (Coates, 2006), however, faculties, administrators, other educational institutions and industries have been identified as the major stakeholders for online universities (Bowers, 2008; Bozkurt, 2012). Nikolov (2009), discussing the research mission of universities, adds researchers, politicians, technologists, companies and peers to VU stakeholders.

7.11. Conclusion

In order to make the USR ontology applicable for the context of the VU, this chapter aimed to describe the specification of the ontology. Therefore, the seven identified aspects for the concept were reviewed and their modifications were discussed in different sections of this chapter accordingly. In line with specification of the USR aspects for the online education setting, the ontology-based representation of the VUSR concept was generated. In the next chapter, this representation of the VUSR knowledge will be considered to identify the criteria and sub-criteria (indicators) for the concept's measurement framework.

Chapter 8_ The Ontology-Based Measurement for Virtual University Social Responsibility

8.1. Introduction

This chapter aims to outline the VUSR measurement framework according to the ontology-based VUSR representation. Therefore, the first section presents the hierarchy of VUSR measurement. Considering the outlined hierarchy, the VUSR measurement criteria and their dimensions will be defined in section 8.3. In section 8.4 the focus is on the first aspect of the VUSR, therefore the measurement criterion considering its dimensions will be defined. In this section the indicators associated with the first measurement criterion will be defined. Definition of the second measurement criterion, namely research, will be presented in section 8.5. It also provides a detailed overview of the indicators for the research aspect of VUSR. Section 8.6 defines the service provision aspect of VUSR as the third measurement criterion along with its indicators. The definition of the fourth measurement criteria (i.e. engagement) as well as its indicators will be provided in section 8.7. The last VUSR measurement criterion, which is transparency and its indicators, will be defined in section 8.8. Finally, the chapter will be concluded.

8.2. Overview of the Ontological-driven Measurement for USR/VUSR

Chapter 5 presented an ontological approach to the measurement of the VUSR as shown below in Figure 8.1:

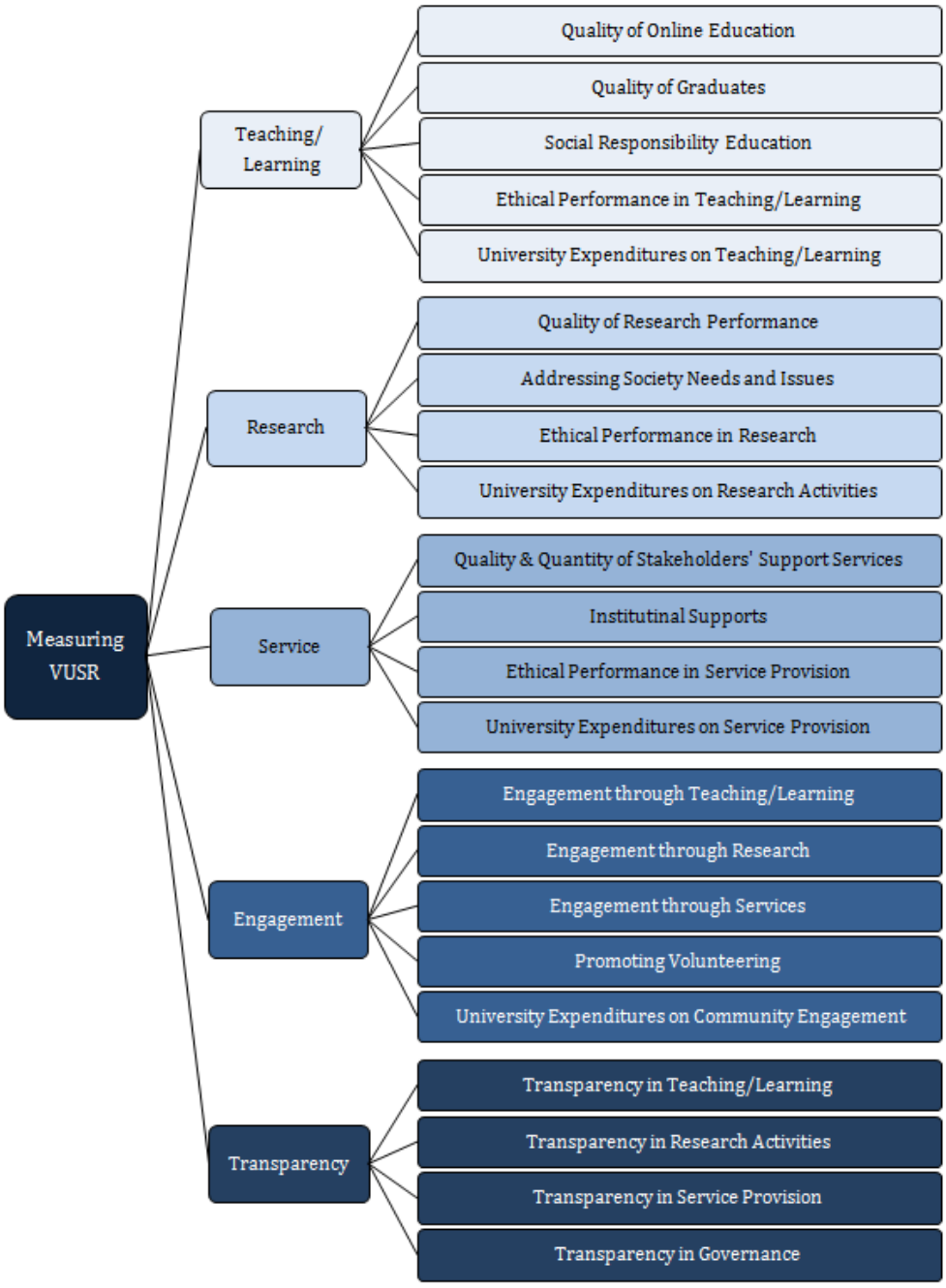


Figure 8-1 The Ontology based measurement for USR (copied from Figure 5.2)

Based on the upper ontology developed for USR and VUSR, the five top measurement areas were:

1) Education
2) Research
3) Engagement (industry etc.)

4) Services (community outreach etc.)
5) Transparency.

In the context of measurement, the above were defined as the **five measurement criteria dimensions**. The following concepts were defined as **impact measurement** together with economic impact, namely:

1) Ethical
2) Stakeholders (social impact)
3) Economic.

In order to carry out measurement along the five key criteria dimensions, **measurement indicators** were developed for each of these five measurement criteria dimensions, and were then further defined as the **performance attributes** against each indicator along each measurement criteria dimension. Therefore, the overall measurement framework consists of (see Figure 8.2):

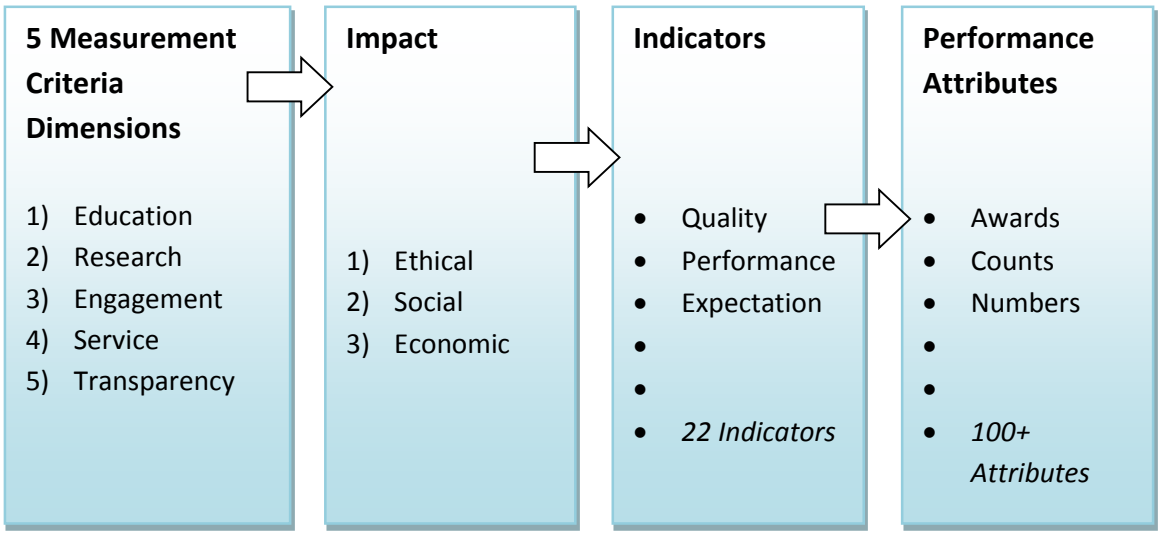


Figure 8-2 The framework for the ontological-driven measurement for USR/VUSR

In the next part of this chapter, each of the five measurement criteria dimensions, their social economical and ethical impact, and the measurement indicators are described, and in the following chapter, the attributes identified to help the measure are described.

8.3. Five Measurement Criteria Dimensions

According the ontology-based VUSR representation and the existing literature regarding VUSR components, the hierarchy of VUSR measurement has been established. The available background for identification and measurement of each VUSR indicator, as referred to in Chapter 2 (see section 2.6), has been considered to establish this hierarchy. The hierarchy of VUSR measurement as shown in Figure 8.2 comprises two levels. The first level represents five main measurement criteria (MC) and the second level illustrates the indicators (sub-criteria) for each MC. The following sections aim to address each MC and its associated sub-criteria in detail.

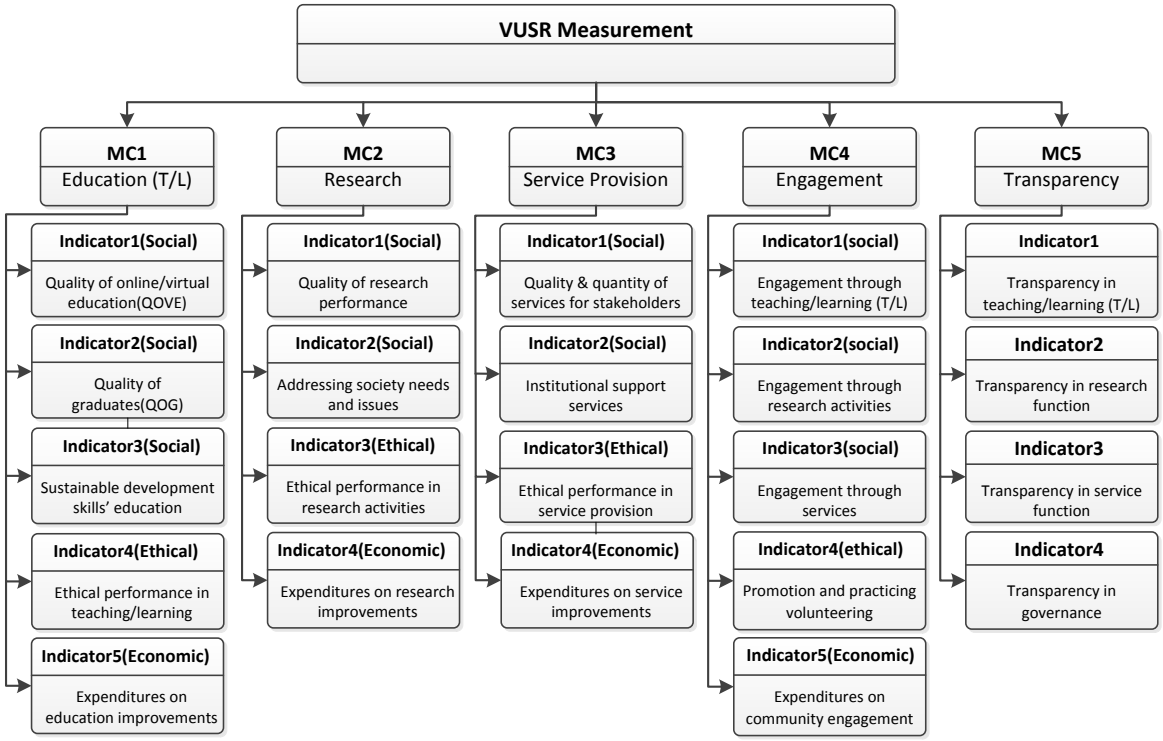


Figure 8-3 The hierarchy of VUSR measurement criteria

As can be seen, the VUSR measurement hierarchy outlined five ontology-based measurement criteria, three of which are the trinity of university functions (i.e. teaching, research and service provision). In this research, these three criteria are called primary criteria, as they highlight the main university functions expected from every higher education institution. However, these primary criteria in the context of social responsibility will be investigated to find the extent to which a given online university

contributes to improving the quality of life of its society. The primary criteria as hierarchy shows proposed to be measure in three dimensions including social, ethical and economic. There are two other criteria for VUSR measurement, i.e. engagement and transparency, which are called secondary criteria. The secondary criteria have been driven from social responsibility context and proposed to be measured through university functions. All these criteria and their indicators will be defined in the following sections.

8.3.1 Measurement Criteria Dimension 1 – Education (Teaching/Learning)

The first measurement criterion (MC1) considers all educational activities that happen in a VU, including teaching and learning activities. This criterion will measure the university's commitment to improving the quality of life of its stakeholders and society at large through teaching/learning activities. This commitment has three dimensions, social, ethical and economic. In the VUSR metrics, each dimension will be measured through its indicators. These indicators will be outlined in section 8.5.

8.3.2 Measurement Criteria Dimension 2 – Research Activities

As the hierarchy shows, the second measurement criterion (MC2) refers to the university's research activities. This criterion outlines a number of indicators which can show the extent to which the university contributes to improving the quality of life of its society by conducting research activities. This commitment, similar to the previous criterion (MC1), is measureable in three dimensions of social, ethical and economic. The specific indicators for these dimensions will be outlined in section 8.6.

8.3.3 Measurement Criteria Dimension 3 – Service Provision

In the developed hierarchy, the third measurement criterion (MC3) indicates the service provision function of online universities. It is important to note that this criterion refers to all sorts of facilities that a university provides, apart from its research and educational functions, for the university stakeholders. Considering this specification, the MC3 will measure the university's commitment to improving the

quality of life of its society through service provision. Similar to the previous criteria, the MC3 is also comprised of three social, ethical and economic dimensions. The specific indicators for each dimension will be outlined in section 8.7.

8.3.4 Measurement Criteria Dimension 4 – Engagement

The fourth measurement criterion (MC4) is engagement, which highlights the university's interactions with its communities. This criterion has been considered to measure the extent to which the university contributes to its internal and external communities in a reciprocal and beneficial way based on shared goals to improve the quality of life of its stakeholders and the society at large. As university engagement with its community mostly occurs through its functions (i.e. teaching, research and service provision), the measurement approach for this indicator also will consider the MC4 through these functions.

8.3.5 Measurement Criteria Dimension 5 – Transparency

The last measurement criterion (MC5) is transparency, which signifies the level of the university's openness in its policies, practices and procedures. This criterion has been considered to measure the extent to which university stakeholders can be informed about university policies, decisions and procedures that may influence them. The level of transparency of university policies and practices can be measured in different aspects of online university functions. These dimensions will be defined as the MC5 indicators in section 8.9.

In order to make these criteria measureable, it is necessary to identify the indicators of each criterion in the main context of VUSR. The sub-notions of each concept in VUSR ontology help the researcher to achieve this. The indicators for each MC can be considered as the sub-criteria for measuring the concept of VUSR. These sub-criteria are comprised of a number of sub-components that can form their sub-indicators. In the next section, according to the ontology-based VUSR representation and the existing literature for measuring social responsibility in the context of higher education (sub-section 2.2.2), the indicators and sub-indicators for each MC will be

defined. The following sections outline the VUSR indicators for each criterion which can be employed as the measurement sub-criteria.

8.4. Impacts along the Five Measurement Criteria Dimension

As the VUSR representation shows, VUSR happens through university missions, i.e. education (teaching/learning), research activities, service provision for stakeholders, as well as engagement (through the aforementioned functions) and it needs to be transparent and ethical. This representation of knowledge indicates that the concept of VUSR is viewable and measureable through the university's commitment to its main functions and its community engagement. The level of transparency of the university's operations in its functions is also a criterion by which the concept can be measured. In this research therefore, education (teaching/learning), research activities, service provision, community engagement and transparency have been considered as VUSR measurement criteria. In the previous section, it was mentioned that the first three criteria which point to the higher education functions (education, research and service provision) are named primary criteria, and the two others, which have been driven from social responsibility context, are secondary criteria.

In this context, although the social dimension of VUSR is the major focus of the measurement approach, there are two other important dimensions that have been considered. As the online university's commitment to ethics/ethical dimension has been recognised as one of the VUSR sub-notions, it is necessary to take this dimension into account in development of the indicators for the primary MCs (i.e. university main functions). Considering the existing approaches for social responsibility measurement in the higher education context (see section 2.5), a third dimension, i.e. economic, is required to be taken into account in VUSR metrics. Therefore, the VUSR measurement criteria (the second level of VUSR measurement hierarchy) will be measured in three dimensions, social, economic and ethical. As shown in Figure 8.3, the MC5, i.e. transparency, is an exception in this hierarchy. The reason is that this aspect of social responsibility is about ethical performance. These measurement criteria and their dimensions will be defined in the following sub-sections.

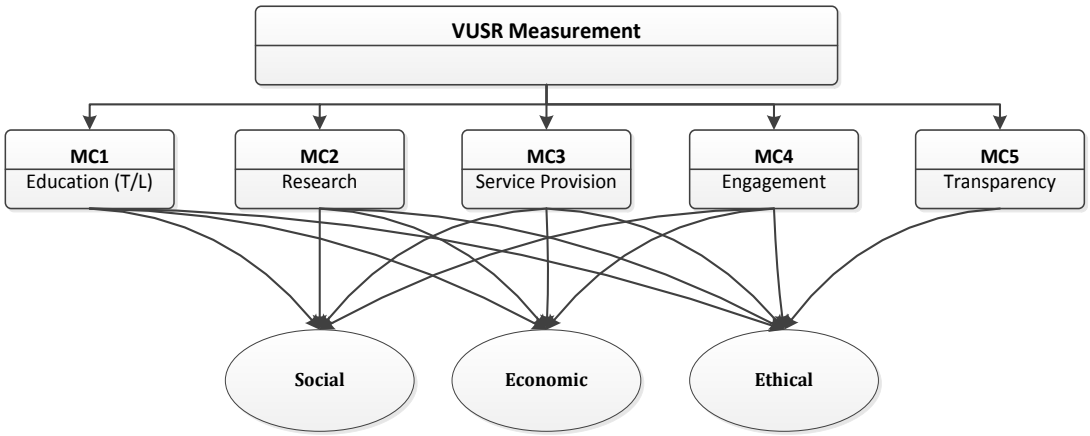


Figure 8-4 The impacts of VUSR measurement dimensions are social, economic and ethical

8.5. Indicators in Educational (T/L) in Social, Economic and Ethical Dimensions

This criterion is comprised of three main dimensions. The first is the social dimension, which refers to the university's commitment through teaching/learning activities to improve the quality of life of its stakeholders and society at large. This can be done by providing high-quality education as well as nurturing new generations in such a way that prepares them to be responsible citizens to their society. The second dimension of MC1 highlights the ethical aspect of teaching/learning activities. This dimension is comprised of the indicators that show how the university contributes to ethical performance through teaching/learning activities. Providing educational opportunities for disadvantaged groups, preparing learning material for learners with special needs, and following the ownership and copyright policies for online learning content are the main features of the ethical aspect of the MC1. The third dimension of this MC is its economic aspect which refers to the amount of money that the university spends for education improvement.

As can be seen in the ontology-based VUSR representation, QOVE, quality of graduates (QOG) and social responsibility education have been identified as the sub-components of the education factor. Considering the literature on the first two

components (see section 2.3), it can be seen that the second component (i.e. QOG) and its associated factors such as graduates' career placement and their employment status have been assumed as the indicators for measuring the quality of online education. However, in the context of VUSR, because of the importance of the sub-notion of QOG, it has been considered as a self-determining indicator. As Figure 8.4 shows for the first criteria (MC1), there are five main indicators, QOVE, QOG, social responsibility education, ethical performance in teaching/learning and university expenditures on education improvements.

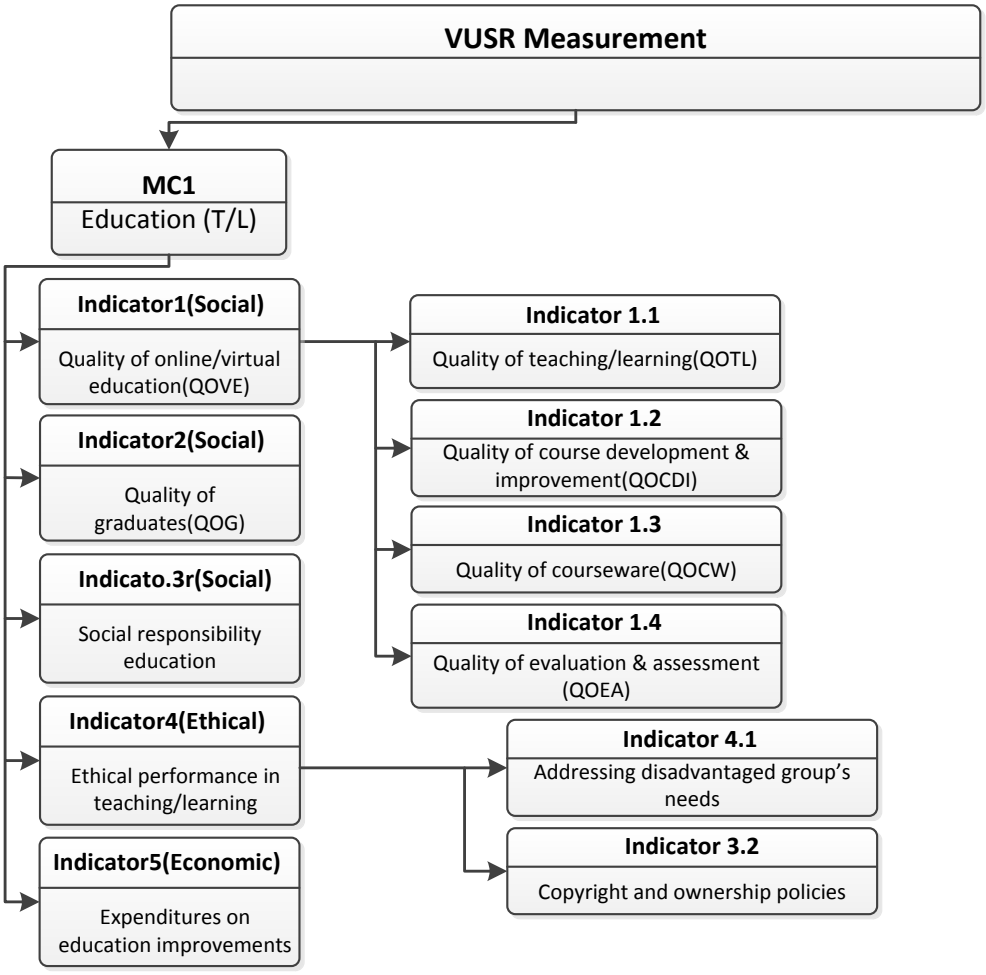


Figure 8-5 The indicators (sub-criteria) for MC1

The first three indicators denote the social aspect of MC1, the fourth indicator points to the ethical dimension and the last one highlights the economic dimension of MC1. As can be seen in Figure 8.4, indicators 1 and 4 each comprised of a number of sub-indicators which will be defined in this section.

8.5.1 Quality of Online/Virtual Education (Social)

As the ontology-based VUSR representation shows, the QOVE has been defined through a number of sub-notions which have been considered as the indicators for this concept. Based on the existing measurement approaches for QOVE (see section 2.6.1), there are a variety of approaches for QOVE measurement. In each approach, a variety of criteria have been employed to quantify the factor. Taking into account the existing contributions, the researcher proposes four major sub-criteria (indicators) for measuring QOVE (see Figure 8.4) each of which comprises a number of sub-components and performance attributes. These indicators have been defined in the following sub-sections.

8.5.1.1 Quality of teaching/learning (QOTL)

Quality of teaching activities refers to the instructors' skills and the efficiency of their interactions with the online students. It also refers to the quality of feedback which the online learners receive from their instructors. Quality of learning, also as a part of this indicator, signifies the success of online learning programs in the implementation of learning pedagogies in such a way that involves online students actively in the educational programs. In this perspective, a high-quality learning program should engage distance students in high-level thinking skills such as analysing, synthesising and evaluation through learning modules, tasks and assignments. According to the literature (see section 2.3.1), the quality of learning depends on a number of factors including the incorporation of learner-centred pedagogies, students' involvement in active learning techniques, students' engagement with real-life activities, respecting diverse learning styles and facilitating collaborative learning opportunities. All these factors can be considered for the measurement of this indicator.

8.5.1.2 Quality of course development and improvement (QOCDI)

The QOCDI indicator is considered in this metrics to measure the extent of the virtual university's contribution to develop high-quality course material and effective course structures. This indicator can be measured through students' satisfaction of the course structure, evidence of following standards and templates for course development, and the level of incorporation of different experts for course development. The QOCDI will also measure the university's endeavours to improve the quality of course

materials and structure. This aspect of the indicator will be measured through evaluation of the university peer review policies and the frequency of reviews for different elements of the online courses.

8.5.1.3 Quality of courseware (QOCW)

While the previous indicator aims to measure the quality of course structure and the university's attempts in developing and improving online courses, this indicator, i.e. QOCW, measures the actual quality of courseware according to online learners' perceptions. This indicator will measure quality of technical and pedagogical aspects of online courses. Pedagogical quality of a virtual course refers to the QOCW in regard to engaging online learners in deep learning through interactive activities, collaborative tasks, teamwork activities, experiential learning, and so on. The technical aspect refers to the technological features of the virtual course, such as quality of design, organisation of information, communication tools, navigation, accessibility of WebPages for different users, and availability of help tools.

8.5.1.4 Quality of evaluation and assessment (QOEA)

The QOEA is the last indicator for the QOVE, signifying the extent in which the virtual university contributes to providing high-quality education through evaluation of its programs and processes as well as students' assessment. As can be seen, this indicator is measureable in two aspects. The first is program evaluation from different perspectives, including teaching activities, faculty performance, technology effectiveness, useability testing, support services and unit evaluation surveys. The second aspect measures the indicator through a number of quality criteria about students' assessment in different levels, such as entry assessments, formative assessments, summative assessments, incorporating strategies to prevent plagiarism and student satisfaction of assessment techniques and tools.

It is important to mention that most of the discussed quality factors cannot be measured directly, however, the level of their achievement in an online university can be questioned from online learners as the primary stakeholders in this context. In other words, virtual students' satisfaction can be surveyed to identify the level of achievement of some of the sub-indicators.

8.5.2 Quality of Graduates (Social)

Although in the literature, the QOG has appeared as one of the factors of QOVE, in this research, it has been considered as an indicator for the education factor of VUSR. The QOG in the VUSR representation appears with three associated concepts, completion rates, final results and outcomes and employability. Considering its associated terms, this indicator can be measured through criteria, such as completion rates of online graduates in different levels, graduates' final grades and publications, as well as their employability. Although the first two criteria (completion rates and final results) are usually available and easy to be measured, the third criterion, i.e. employability of graduates, is quite a challenge to quantify.

8.5.3 Social Responsibility Education (Social)

This indicator aims to evaluate the extent to which the VU contributes to nurturing online students as socially responsible citizens who, besides their skills and knowledge in their fields of study, have at least some basic knowledge of social responsibility. This contribution can happen through providing optional or compulsory learning modules with the subject of social responsibility. This indicator can be measured considering the quantity of social responsibility learning modules or other teaching activities provided by the VU.

8.5.4 Ethical Performance in Teaching/Learning (Ethical)

The ethics in the ontology-based VUSR representation has been recognised as one of the dimensions of USR. Consequently, in the proposed VUSR metrics, one of the aspects of measuring the education (teaching/learning) component is the university's ethical performance in teaching/learning. This ethical performance can be measured through two following sub-indicators.

8.5.4.1 Addressing disadvantaged groups' needs

The first sub-indicator for ethical performance of a VU in its educational function refers to its contribution in addressing disadvantaged groups' needs. The

disadvantaged group in this context can be defined as students who financially or physically are disadvantaged or handicapped. Therefore, this indicator can be measured by looking at the number of students from lower socio-economic backgrounds that the online university supports because they are not able to afford online education. This measure also needs to consider the educational support that the university provides for those who are physically disabled. For example, the university's commitment to provide special learning materials for those who have sight problems can be considered in this sub-indicator.

8.5.4.2 Policy of copyright and ownership

The second aspect of the online university's ethical performance in its educational function refers to its commitment to not only follow copyright and ownership policies, but also to teach the value of fair use of online material to the students and staff. In order to measure this indicator, evidence of university policies regarding ownership of online learning material, plagiarism and fair use of material need to be considered. It is also important to evaluate how the university performed in encouraging the value of fair use and its related legal roles in the online staff and students.

8.5.5 University Expenditure on Education Improvement (Economic)

The last indicator of MC1 is highlighting the economic aspect of this VUSR measurement criterion. This indicator aims to measure the economic contribution of VUs to improve their teaching/learning function in the context of social responsibility. These expenditures can be devoted to the different aspects which have been discussed regarding MC1. The university expenditures on education provision for online students, online staff professional development and educational programs planned to improve the employability of graduates can be some aspects of this indicator. More details regarding the measurement components and attributes for this indicator will be outlined in the next chapter.

8.6. Impact Indicators in Research in Social, Economic and Ethical Dimensions

The second measurement criterion in the VUSR metrics is university research activities. This criterion has been established to measure VUSR in three social, ethical and economic dimensions. Like the previous criterion (MC1) the social dimension of MC2 considers online university contributions for improving the quality of life of the society at large. However, this criterion is measuring the university's contribution through its research activities.

As shown in Figure 8.5, MC2 is comprised of four major indicators, quality of research, university's contribution addressing disadvantaged groups' needs, university ethical performance in research activities and university expenditures on research in the context of social responsibility. The MC2 indicators were decided based on the concept relationships in the ontology-based VUSR representation (Figure 7.1) as well as the existing measurement approaches for social responsibility in the context of higher education (see section 2.5). These indicators, the MC2 sub-criteria, will be defined in the following sub-sections.

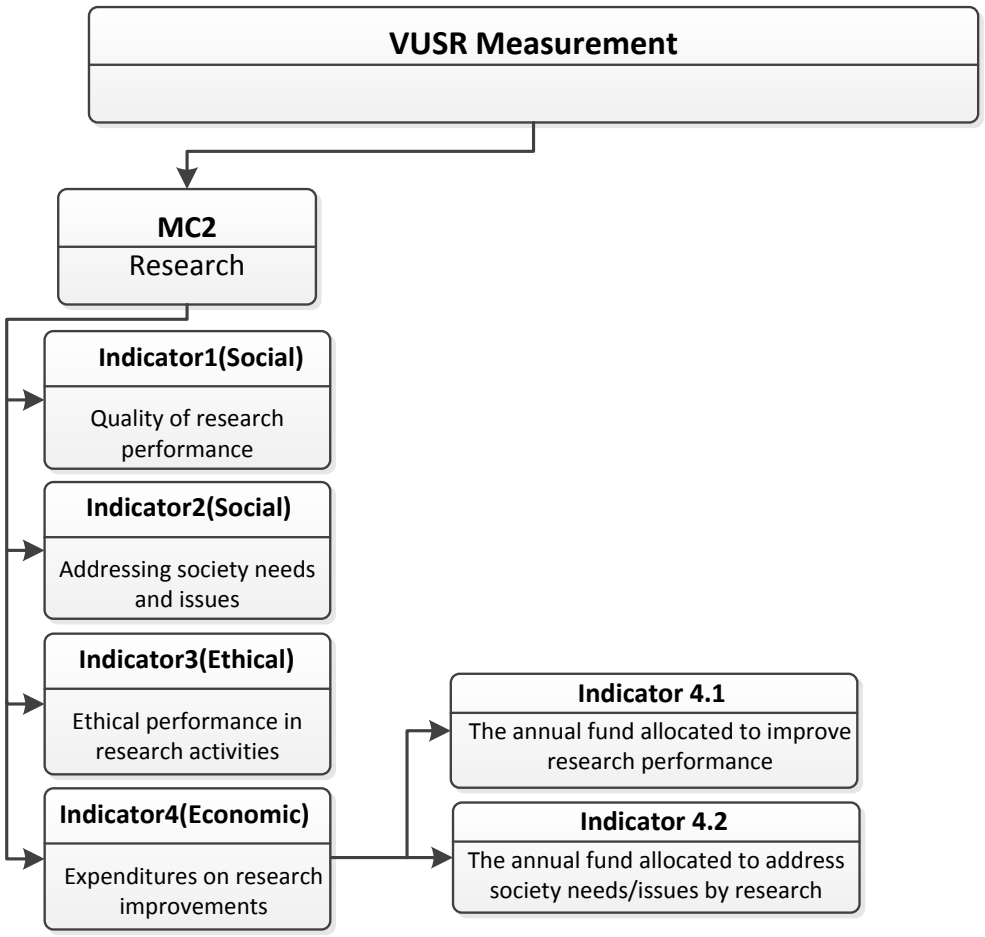


Figure 8-6 Indicators (sub-criteria) for MC2

8.6.1. The Quality of Research Performance (Social)

As quality research is recognised to be one of the sub-notions of the research component in VUSR ontology, it can be considered one of the indicators for the research function of VUs in the context of social responsibility. This indicator aims to measure the university's contribution to improving the quality of life of society by its commitment to high-quality research. The quality of research has been defined through a number of attributes which will be outlined in the next chapter.

8.6.2. Addressing Society's Needs and Issues (Social)

According to the VUSR ontology, VUs like other universities are expected to contribute to their society's improvement by conducting research projects designed to address community issues. This commitment can be achieved by developing PhD or

Masters research projects based on community problems in a variety of fields, such as education, health, industry, economics, cultural and environmental, at local or global levels.

8.6.3. Ethical Performance in Research Activities (Ethical)

While the previous indicators highlighted the social dimension of MC2, the third indicator points to the ethical dimension of the research function of the VU in the social responsibility context. This indicator mainly measures the university's conduct regarding intellectual property in research activities. The attributes for measuring these three indicators will be outlined in the next chapter.

8.6.4. University Expenditure on Research Improvement (Economic)

The economic aspect of the MC2 refers to the university's expenditure on the improvement of research activities in the context of social responsibility. As shown in Figure 8.5, this indicator is comprised of two sub-indicators described below.

8.6.4.1 The annual funds allocated to improve research performance

In the VUSR context, a socially responsible online university is expected to spend financial resources annually in order to improve the quality of its research function. The amount of this expenditure in the VUSR metrics is proposed as one of the sub-indicators of the MC2. This can be measured through evaluation of the university's expenditure on different aspects of the research function.

8.6.4.2 The annual funds allocated to address society's needs/issues by research

Another sub-indicator for the economic dimension of MC2 is intended to measure the annual funds which the VU allocates to research projects that aim to address society's needs and issues. This sub-indicator will be evaluated by calculating the funds which the online university spends annually on research projects in aspects such as education, health, local industries etc.

8.7. Impact Indicators in Service Provision in Social, Economic and Ethical Dimensions

According to the definition of the third VUSR measurement criterion (i.e. service provision) and its associated notions in the ontology-based VUSR representation (Figure 7.1), four major indicators have been identified for MC3 (see Figure 8.6). These indicators aim to measure MC3 in three social, ethical and economic dimensions. The MC3 indicators in the social dimension include quality and quantity of service provision for VU stakeholders and VU institutional support services. The ethical dimension of MC3 is proposed to investigate and measure the VU's ethical performance in service provision. The economic dimension will evaluate the MC3 considering the university's expenditure on service provision and improvement.

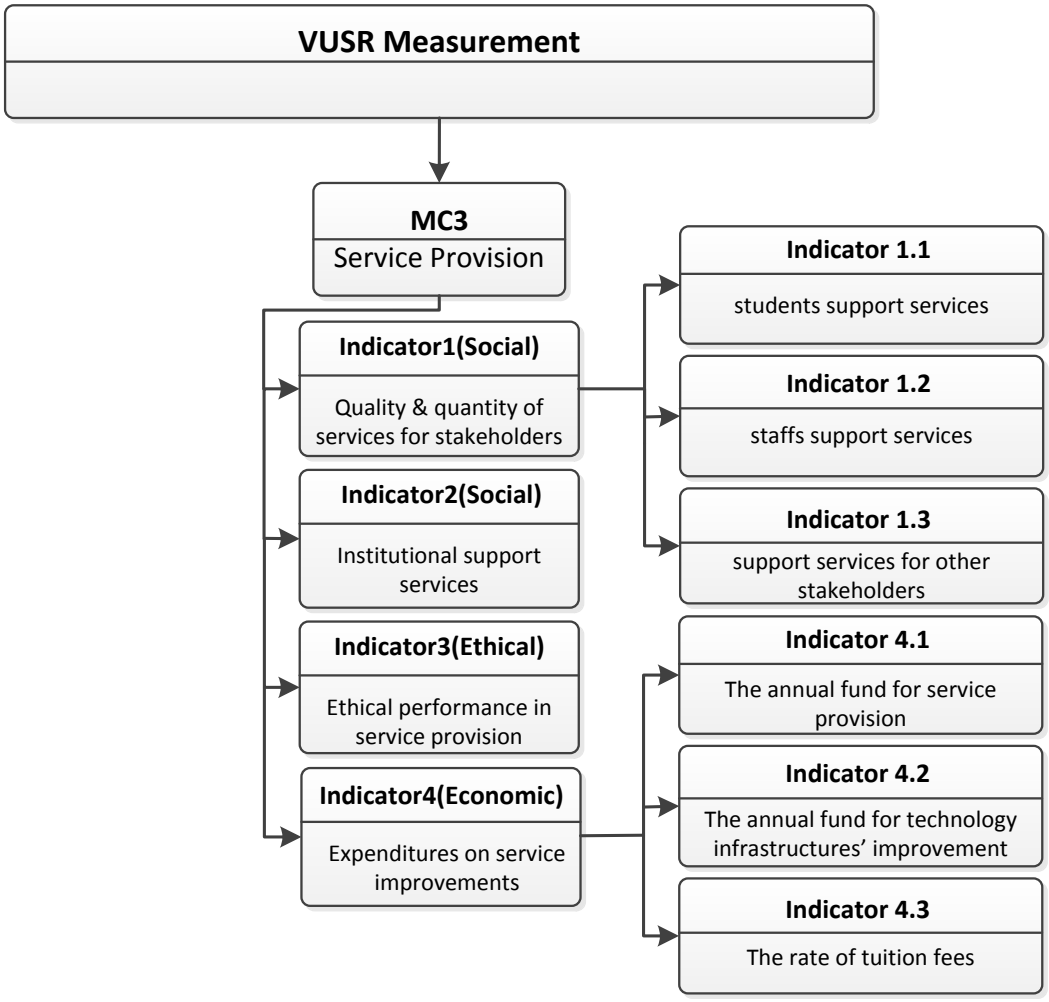


Figure 8-7 Indicators (sub-criteria) for MC3

All these indicators are intended to measure the VU's contribution to improving the quality of life from different aspects of service provision as defined in the following sub-sections.

8.7.1. Quality and Quantity of Services for Stakeholders (Social)

The quality and quantity of support services which the VU provides for its stakeholders has been recognised as the first indicator for MC3. As mentioned in the literature (see 2.3.6 and 2.3.7), the VU's support services can be in a variety of forms such as consultation services, university facilities and access to university events. In the VUSR metrics, the level of the university's contribution to provide these supports signifies the quantity of support services and the level of stakeholders' satisfaction with them as representing the of quality of these services. This indicator has been organised to measure the support services in three sub-categories, student, staff and other stakeholder support services. Each of these categories has been defined below.

8.7.1.1 Student support services

Regardless of educational service that the VU provides in the form of online course materials, it is responsible for arranging support services for online students as its main stakeholders. These services can assist online students in different phases before and after registration and are supposed to support students' needs outside the actual classroom. For example, the online university is responsible for providing enough information regarding an online course and its requirements, allowing students to start their study with a correct understanding of the course they have chosen. The ideal is that students also have advisory services before starting their online study, enabling them to choose what is suitable based on their skills, qualifications, interests and needs. The online university is also responsible for providing a variety of support services for online students during their studies. These can include but not be limited to providing required information regarding online units and assessment policies, technical assistance, training on how to use online sources, encouragement for excellent performance and innovative practices, consultation services for online students, and so on.

8.7.1.2 Staff support services

The online university staff also needs a variety of supports, including promotion plans for their recruitment and consultation services regarding their job requirements and their personal life. This sub-indicator is intended to measure the university's contribution to supporting its staff (both academics and non-academics) by providing counselling services, skills' development training, promotion plans and establishing better recruitment policies.

8.7.1.3 Support services for other stakeholders

Besides university staff and students, VUs are expected to contribute to support service provision for other stakeholders such as other universities' students, educational institutions (e.g. K-12 institutions), as well as members of the public. These services include but are not limited to advisory services, sharing university resources and educational programs (e.g. seminars, workshops, etc.) or advisory services.

8.7.2. Institutional Support Services (Social)

Institutional support is another indicator for MC3 which is proposed to measure the VU's contribution to enhancement of institutional and technological infrastructures of their system. Some aspects of this indicator are the availability of information for stakeholders, addressing security and privacy concerns, and improvement and maintenance strategies.

8.7.3. Ethical Performance in Service Provision (Ethical)

Similar to MC1 and MC2, the MC3 will also be measured considering the ethical performance of university. This indicator will measure the university's contribution to serve disadvantaged groups in the community by service provision (excluding education provision which was discussed in MC1). The recruitment of students and staff from disadvantaged backgrounds or with disabilities and fair work practices are examples of this ethical commitment. Another important component of VU ethical

performance in service provision is the university's commitment to ethical codes in its communications with the stakeholders. All these factors can be considered when identifying the performance attributes for the measurement of the ethical performance of VUs in service provision.

8.7.4. University Expenditure on Service Provision and Improvement (Economic)

In the VUSR metrics, the economic aspect of MC3 will be measured by evaluation of the amount of money which the online university spends on its third function, i.e. service provision beyond the actual classroom. This indicator is comprised of three components (sub-indicators) as outlined in the Figure 8.5 and detailed below.

8.7.4.1 Annual funds for service provision

As the online university is expected to provide services for different stakeholders, as mentioned in the 8.6.1 indicator, in the economic dimension of the MC3 measure the annual fund which the university allocates to these stakeholders (students, staff, and others) is proposed as one of the measurement sub-criteria.

8.7.4.2 Annual funds for technology infrastructure improvement

In this dimension, besides the service provision funds, the annual funds that the university spends to improve the technology infrastructure is proposed as another sub-criteria for the economic dimension of MC3. This infrastructure can include the course management system, upgrading hardware and software components.

8.7.4.3 The rate of tuition fees

A socially responsible VU is expected to consider its stakeholders' benefits more than just private profits, therefore in such a context the rate of tuition fees that online students are charged can be considered one of the indicators. This rate should be fair and based on the quality of service that online students receive from the VU.

8.8. Impact Indicators in Engagement in Social, Economic and Ethical Dimensions

The online university's engagement with its communities has been recognised as the fourth measurement criteria (MC4) for VUSR metrics. In order to measure VUSR based on the MC4, a number of indicators are defined in this section. The university's engagement with its community, as shown in the ontology-based representation of VUSR, can be achieved through different university functions. Therefore, these functions have been considered to develop the indicators of MC4. As Figure 8.7 illustrates, based on the ontology-based representation of VUSR, MC4 is comprised of five main indicators, which will be defined in this section.

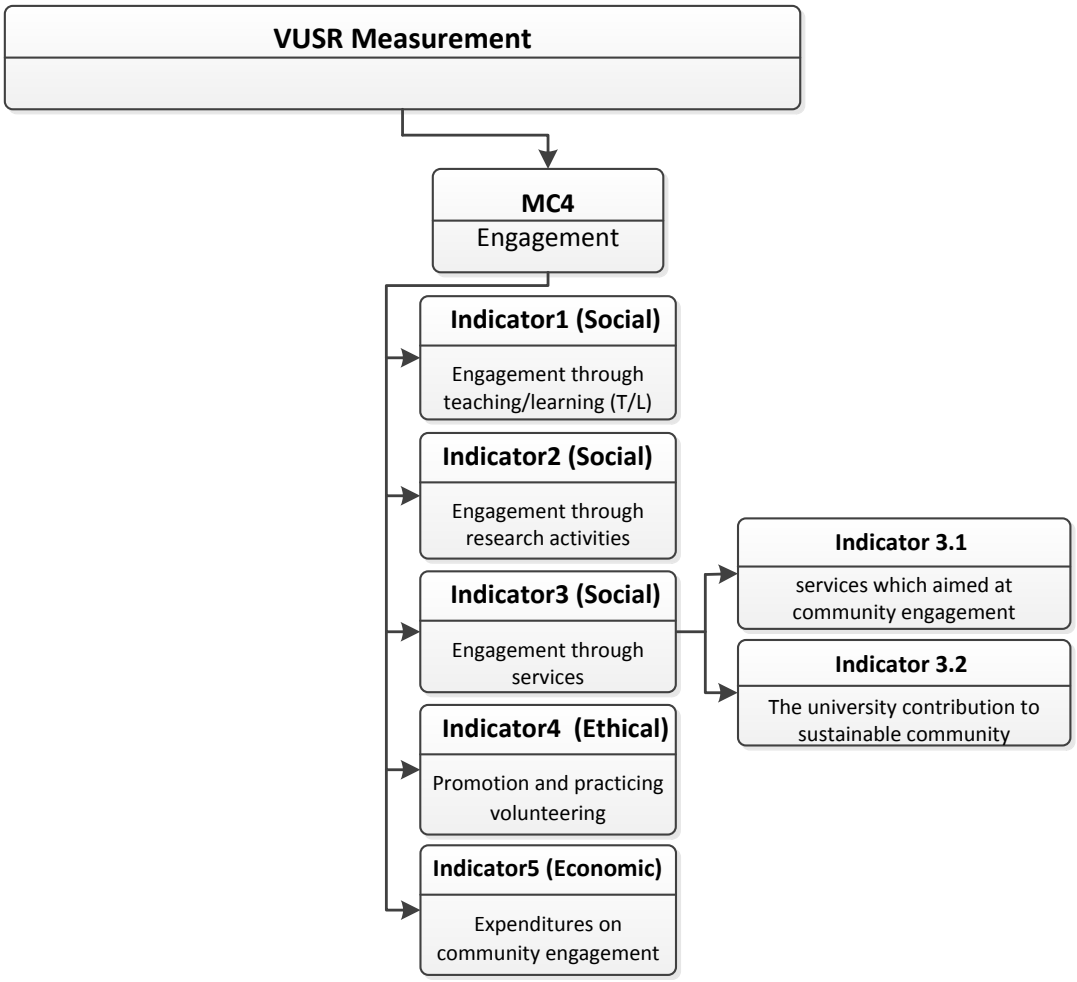


Figure 8-8 Indicators (sub-criteria) for MC4

8.8.1. Community Engagement through T/L Processes (Social)

This indicator is intended to measure the variety of university contributions to engagement with its internal and external communities to not only improve the quality of the online education experience for its students and staff, but also to benefit its external community, including university partners, employers, public members and so on, through its educational function. Therefore, this indicator is measureable in two aspects, including the university's internal community engagement and the university's external community engagement.

8.8.2. Community Engagement through Research Activities (Social)

As mentioned in the literature review (see 2.5.1 sub-section), university community engagement can be measured through its trinity of functions, one of which is research activities. Considering the literature, it was decided to measure this indicator (MC4) through research activities in those online universities that have research functions like a conventional university. This indicator can be evaluated by investigating university research projects that involve both university staff and community members.

8.8.3. Community Engagement through Services (Social)

Similar to the previous indicator, considering the literature (section 2.5) and the ontology-based VUSR representation, community engagement through university services are suggested as the third indicator for MC4. This indicator is comprised of two sub-indicators outlined below.

8.7.3.1 The university's contribution to a sustainable community

The first sub-indicator highlights the online university's contribution to sustainable community development. In this view, those university policies and practices aimed at the sustainable consumption of energy and resources will be measured.

8.7.3.2 The university's services aimed at community engagement

This sub-indicator refers to the university services aimed at community engagement. The services to be measured are those organised considering specific community needs and issues. It is important to mention that the community here is referring to the local/national levels.

8.8.4. Practising and Promoting Volunteering (Ethical)

According to the ontology-based VUSR representation another sub-concept for the engagement component is the notion of volunteering. Therefore, this aspect of university community engagement is proposed as the next indicator for MC4. The indicator of practising and promoting volunteering aims to measure the VU's contributions in voluntary and charitable service for the external community including members of the public. These contributions are supposed to be organised just to benefit society with no intention of advantages for the VU.

8.8.5. Expenditure on Community Engagement (Economic)

The last indicator of MC4 highlights the economic aspect of this VUSR measurement criterion. This indicator aims to measure the economic contribution of online universities to community engagement in the context of social responsibility. The annual funds that the university spends on community-related services, voluntary activities and charitable services are aspects of this indicator.

8.9. Impact Indicators in Transparency in Social, Economic and Ethical Dimensions

The last ontology-based VUSR measurement criterion (MC5) points to the moral aspects of the online university's operation which is transparency. As demonstrated below (see Figure 8.8), this criterion is comprised of four indicators that highlight the university's openness in different aspects. The first, third and fourth indicators have been proposed based on the literature of the VUSR concept and its ontology-based representation. However, the second indicator, i.e. transparency in research function,

has been borrowed from the context of USR for those VUs that have a research mission. Therefore, if a given university does not have this function, it is necessary to remove this indicator from the VUSR metrics. All these indicators will be defined in this section.

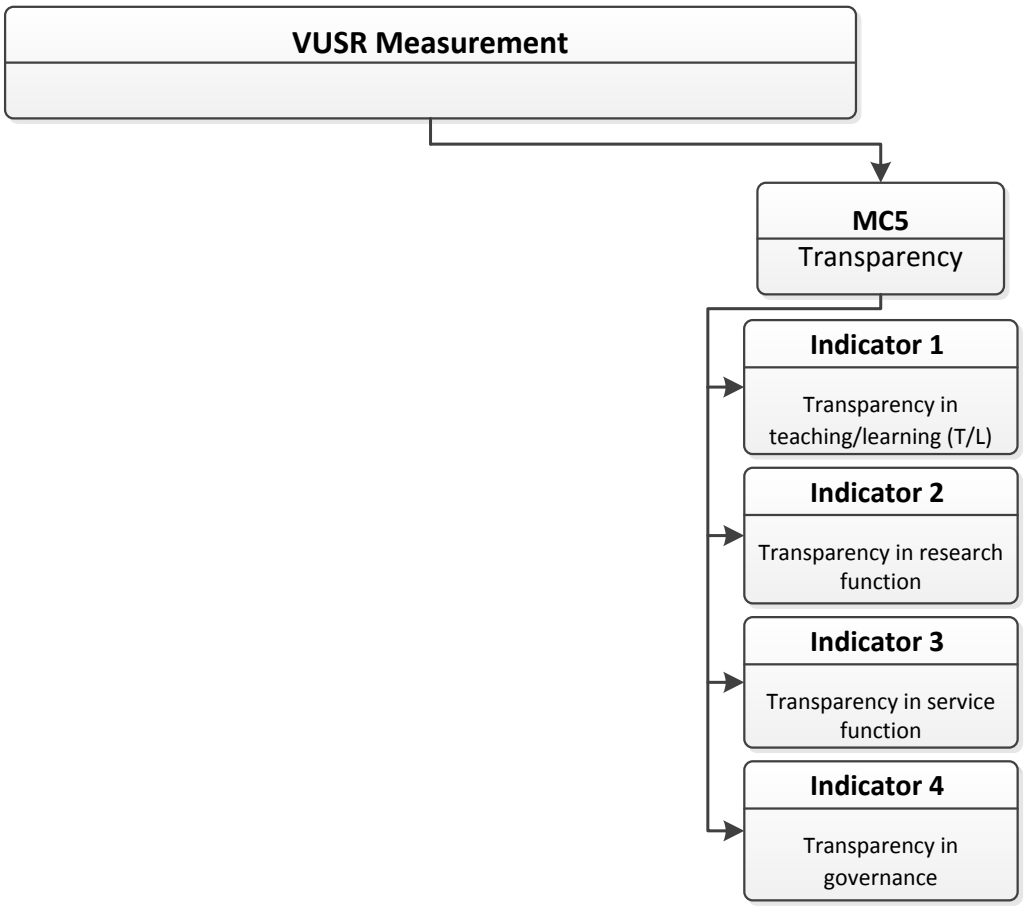


Figure 8-9 Indicators (sub-criteria) for MC5

8.9.1. Transparency in the Teaching/Learning Aspect

Transparency in teaching/learning processes aims to measure the extent to which the university is open regarding its educational function. This means the level to which stakeholders of the VU have been informed about university policies, practices and output in different aspects of teaching/learning. These aspects can include student assessments, academics' evaluations and education quality assurance.

8.9.2. Transparency in the Research Aspect

As mentioned earlier, this indicator is borrowed from the USR context for VUSR measurement and it is applicable for those VUs that have a research function similar to conventional universities. In this sense, the proposed indicator aims to measure how open the university is in research-related policies and practices, especially in the funding aspect.

8.9.3. Transparency in the Service Aspect

In the VUSR metrics, this indicator highlights the evaluation of the university's performance in regard to its openness in support service provision. In the other words, the indicator is intended to measure the level to which university stakeholders have been informed about the support services they can benefit from, and also about the quantity and quality of support services that the university provides during a specific period.

8.9.4. Transparency in the Governance Aspect

This indicator refers to the criterion that allows university stakeholders who may be influenced by administrative decisions to have access to facts, figures, policies and procedures regarding the governing system in the university. The indicator also aims to measure the level to which university stakeholders can contribute to the university's governance.

8.10. Conclusion

In this chapter, the researcher attempted to outline the ontology-based VUSR measurement framework that can be used to quantify the level of the VU's contribution to social responsibility. In this measurement structure, there are a number of VUSR aspects measureable through their indicators. In this regard, the VUSR measurement hierarchy has been demonstrated in section 8.2. Section 8.3 defined the ontology-based VUSR dimensions which the measurement criteria definitions are based on. The rest

of the chapter provided details of the measurement framework, including measurement criteria and indicators for the criteria. Considering the qualitative nature of VUSR indicators, these indicators need to be defined through a number of performance attributes. The next chapter will define the performance attributes associated with each indicator.

Chapter 9_ The Performance Attributes and sub-attributes for the Virtual University Social Responsibility Measurement

9.1. Introduction

In the previous chapter, the ontology-based VUSR measurement criteria and their indicators have been defined. As mentioned, some of these indicators are comprised of sub-indicators (sub-criteria). Most of the defined indicators are not directly measureable and need to be evaluated through a number of performance attributes. The performance attributes are the core element of each indicator which can be designed as a set of questions for the primary stakeholders (such as online students, academic staff and administrators). The stakeholders' answers for each performance attribute can be translated into numbers to calculate the VU score for each indicator.

In this chapter, section 9.2 defines the performance attributes for the education (teaching/learning) aspect (MC1) of the VUSR concept. The performance attributes in this section will be outlined in regard to the three dimensions, social, ethical and economic. Section 9.3 defines the attributes with respect to the research activities in the three dimensions. In section 9.4 the performance attributes of MC3 (service provision) will be outlined in three dimensions of social, ethical and economic. The attributes for measuring MC4 (engagement) will be defined in the same three dimensions in section 9.5. Finally the transparency (MC5) attributes will be defined with respect to its indicators, which will be followed by the conclusion.

9.2. Performance Attributes for MC1-MC5

This chapter uses the Ontological Measurement Framework (Figure 9-1) to describe the performance attributes for each of the indicators in the assessment of social responsibility of a VU.

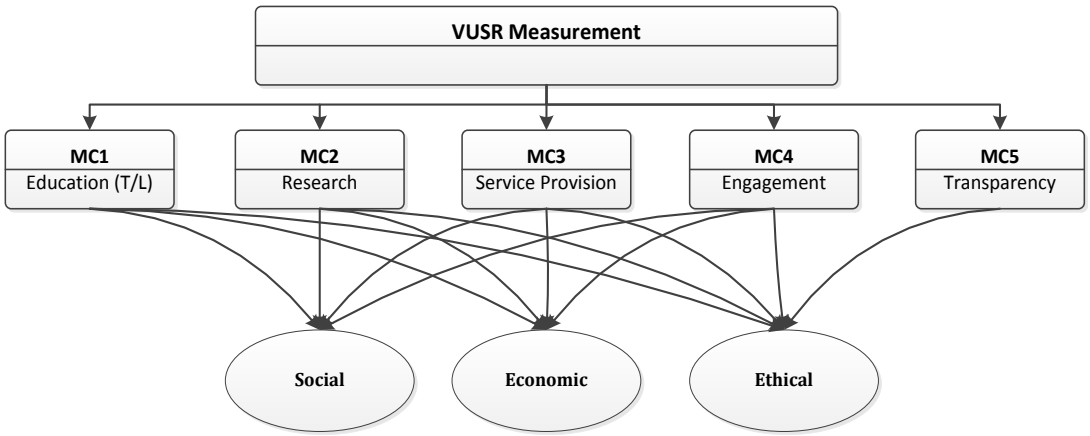


Figure 9-1 The impacts of VUSR measurement dimensions (copied from Figure 8.2)

9.3. Education (MC1) Performance Attributes

As discussed in previous chapter, the concept of social responsibility of VUs can be measured through the VUSR measurement framework which is comprised of criteria and sub-criteria. The first measurement criterion (education) has been defined in three dimensions and through five indicators. This section provides a detailed view of the attributes in three dimensions respecting the five indicators.

9.3.1. MC1 Performance – Social Dimension

The social dimension of MC1 is comprised of three indicators for the teaching/learning aspect of VUSR, including QOVE, QOG, and social responsibility education. Each of these indicators has a number of performance attributes and in some cases sub-attributes, which will be outlined below.

9.3.1.1. The QOVE performance attributes

As mentioned, QOVE has four major indicators, some of which have sub-indicators. Tables 9.1 to 9.4 respectively outline the performance attributes by which QOTL, QOCDI, QOCW and QOEA as the sub-indicators of QOVE can be measured.

Table 9-1 Performance attributes for the QOTL

Attributes	**Sub-attributes**
The average grade of students' satisfaction regarding online teaching components including	**online instructors'** proficiency
	received **feedback** from the instructors in a **timely manner**
	effectiveness of instructors' **feedback** (**informative and constructive**)
	adaptability of teaching with students' **learning style**
	teaching quality in regard to engaging them in **high-level thinking skills**[6]
	availability of opportunities for student–student **collaboration**
	availability of opportunities for **group discussions**
The percentage of units linked to **real-world practices** (in industry)	
The percentage of units teaching **entrepreneurship skills**	
The percentage of **students engaged with entrepreneurial** education units	
The percentage of **work-integrated (experiential**) learning modules	
The **student/staff ratios** (academic staff)	
The percentage of academic staff who received **skill development training**	
The percentage of **academic staff** who **remained** at the university for five years or more	
The percentage of students participating in **evaluation surveys** for each **instructor**	

Table 9-2 Performance attributes for the QOCDI

Attributes	**Sub-attributes**
The average grade of **students' satisfaction** with course structure	**units/modules** organisation
	consistency in course structures
	harmony of course materials with **cultural features**
	availability of **course information** during the course
	availability of **contact information of** instructors and other facilitators

[6]. For example, analysing, synthesising and evaluation.

Existence of **standards/templates**	course **design and development standards**
	course **delivery standards**
The level of **cooperation** faculty with **different experts**	**instructional designers**
	subject experts
	technical experts
	evaluation experts
Existence of **peer review policies** for virtual course development	the average number of **peer reviews** for each **unit**
	the average number of **peer reviews** for each **course**
	the ratio of units undergoing the **peer review process**
	the ratio of courses undergoing the **peer review process**
Existence of **periodical review** policies for **course** structure to meet standards	the frequency of **periodical review** for each **unit**
	the frequency of **periodical review** for each **course**
Existence of **curriculum review** policies for the faculty	the frequency of **curriculum peer reviews**
	the ratio of courses undergoing **curriculum reviews**
	the regular **duration** of reviews of the curriculum for each course

The QOCDI sub-indicator, as mentioned before, can be quantified through a number of performance attributes in the two aspects of course development and course improvement. As Table 9.2 shows, for measurement of the first aspect (i.e. quality of course development) three performance attributes are proposed – quality of course structure (the extent to which students have been satisfied by the quality of the course structure), evidence of standard and templates for course development and the level of faculty cooperation with different experts, such as instructional designers, subject experts, technology experts and evaluation experts. According to the above table, to measure the QOCDI (i.e. quality of course improvement) sub-indicator, four performance attributes are proposed, including the evidence of peer review policies for virtual course development, periodical review policies for course structure to meet standards, curriculum review policies for the faculty and regular review at the program level to ensure clarity, usefulness and appropriateness.

Table 9-3 Performance attributes for the QOCW

Attributes	Sub-attributes
The average grade of students' satisfaction of **pedagogical quality** of virtual **courseware**	the level of support for students' **engagement** in learning activities
	the level of support for **critical thinking**
	the level of support for **collaborative learning**
	the level of support for **teamwork activities**
	the level of support for **experiential learning** (learning by doing)
	content accommodating learners' **individual differences**
	the level of **interactivity**
The average grade of students' satisfaction of **technical quality** of virtual **courseware**	logical **organisation of information**
	screen **design**
	navigation design
	consistency
	availability of **alternative** webpages for **low-speed** internet connectivity
	availability of **alternative** webpage for **visually impaired** learners
	information delivery techniques
	help tools and documentation
	quality and quantity of **synchronous** and **asynchronous** collaborations

As can be seen in Table 9.3, the QOCW sub-indicator has two performance attributes – the pedagogical quality of virtual courseware and technical quality of virtual courseware. It is proposed these performance attributes will be measured in regard to the level of their achievement from the viewpoint of online learners. The above table outlines sub-attributes for each aspect.

In order to measure the QOEA as a sub-indicator for QOVE, in the proposed metrics two performance attributes have been considered – quality of evaluation of programs and processes, as well as quality of student assessments (see Table 9.4). Each of these attributes has sub-attributes which are outlined in the table below.

Table 9-4 Performance attributes for the QOEA

Attributes	Sub-attributes
The average grade of quality of evaluation of programs and processes	evidence of standard evaluation processes to evaluate **teaching processes' effectiveness**
	evidence of standard evaluation processes to evaluate **learning processes' effectiveness**
	evidence of standard evaluation processes to evaluate **learning material effectiveness**
	evidence of standard evaluation processes to evaluate **learning environment effectiveness**
	evidence of standard evaluation processes to evaluate **technology effectiveness**
	evidence of evaluation of **program effectiveness** through analysing data on enrolment, costs, etc.
	evidence of regular evaluation of **faculty performance**
	evidence of regular evaluation of **faculty support services**
	evidence of regular evaluation of **student support services**
	the ratio of **units** included in the **evaluation survey to** the total number of university units
	the ratio of **students'** participation in the **evaluation survey** for each **unit**
The average grade of quality of student assessments	the **entry requirements** for **undergraduate** courses
	the **entry requirements** for **postgraduate** studies
	the **entry requirements** for **postgraduate** research
	evidence of **formative assessment** for each unit during the course
	evidence of **final assessment** for each unit during the course
	evidence of effective **techniques** in the process of assessment to prevent plagiarism
	the frequency of periodical **review** of learning **assessment tools** and processes
	the average level of **students' satisfaction** with quality of assessment methods

As mentioned earlier in this chapter, some of the quality indicators are not easily quantifiable. Therefore, it is proposed these indicators are measured according to the level of their achievement from the viewpoint of online students as the primary stakeholders for VUs. The QOTL and QOCW are examples of this discourse.

9.3.1.2. The QOG performance attributes

The QOG is the second indicator by which the education (T/L) component of VUSR can be measured. As mentioned in previous section, to measure QOG, its sub-notions as represented in VUSR ontology are applicable. The graduates' final output and results, and their completion rate are the factors by which this indicator can be measured. In the context of VUSR, another important factor for measuring QOG is graduates' employability. This factor is measurable through reviewing the employment status of online university graduates during a period of time (e.g. five years). This indicator can also be measured by investigating whether graduates have been equipped with the basic skills to start their own business (e.g. leadership and entrepreneurship skills). Table 9.5 presents performance attributes by which the QOG can be measured.

Table 9-5 Performance attributes for the QOG

Attributes	Sub-attributes
The completion rate for undergraduates during the last five years (Bachelor degree)	
The undergraduates' **outcomes** on the marking scales during last five years	
The completion rate for Masters students during last five years (by course)	
The postgraduates (by course) **outcomes** on the marking scales during last five years	
The completion rate for Masters students during last five years (by research)	
The completion rate for PhD students during last five years (by course)	
PhD graduates' (by course) **outcomes** on the marking scales during last five years	
The completion rate for PhD students during last five years (by research)	
The level of **research productivity** of research-based Masters graduates	
The level of **research productivity** of research-based PhD graduates	
The percentage of graduates who **participated in entrepreneurship** units	
The percentage of graduates who **participated in leadership** units	
The percentage of undergraduates **employed** fulltime during last five years	
The percentage of postgraduates **employed** fulltime during last five years	

9.3.1.3. The social responsibility education performance attributes

Social responsibility education as the third indicator for VUSR measurement for its education (T/L) component has a number of performance attributes, as shown in Table 9.6. In the proposed metrics, the average score obtained for Table 9.6 shows the average grade of the university's contribution to social responsibility education. As can be seen in this table, this kind of contribution can happen through organising learning modules or other teaching activities such as seminars, workshops, etc.

Table 9-6 Performance attributes for social responsibility education

Attributes
The ratio of optional and compulsory learning modules that aim to educate social responsibility
The ratio of students who attended social responsibility educational programs
Evidence of other teaching activities for social responsibility promotion (seminars, workshops, etc.)
Evidence of educational programs promoting volunteering

9.3.2. MC1 Performance Attributes – Ethical Dimension

In the proposed metrics, the ethical performance of the VU in its teaching/learning function has two sub-indicators. The VU can perform ethically by providing education for those who are not able to afford higher education because of financial issues. To measure this aspect of university performance, two attributes are suggested the in VUSR metrics as shown in table below.

Table 9-7 Attributes for commitment to addressing disadvantaged groups' needs

Attributes
The ratio of financially disadvantaged students who have been enrolled
The ratio of learning modules designed for handicapped/disadvantaged students

Another sub-indicator for a university's ethical performance in teaching/ learning aims to measure the extent in which the university is committed to acknowledging copyright and ownership policies. Table 9.8 outlines the performance attributes for this sub-indicator. As can be seen in this table, this commitment can be

measured considering the university's policies regarding online course material ownership and plagiarism. The two last attributes in the table measure the university's commitment to teaching the fair use of material, as well as legal and ethical aspects to online students and instructors.

Table 9-8 Attributes for commitment to policies of copyright and ownership

Attributes	Sub-attributes
Evidence of copyright and ownership policies for online course materials	
Evidence of university policies to prevent plagiarism	
Evidence of training/information related to academic integrity for **instructors**	
Evidence of training/information related to academic integrity for **students**	

9.3.3. MC1 Performance Attributes – Economic Dimension

The university's expenditure on education development and improvement was defined as an indicator for the economic dimension of MC1in the context of VUSR. The proposed performance attributes for this indicator are outlined in the below table. As can be seen, this sub-criterion has different components, such the annual allocated funds to each online student, staff professional development, social responsibility education and entrepreneurship education.

Table 9-9 Attributes for the university's expenditure on education improvement

Attributes
The annual funds which the university spends for each research student
The annual funds which the university spends for each student (by course)
The annual funds which are allocated to each staff member's continuing professional development and vocational education (CPD/CVE)
The annual funds which are allocated to social responsibility education
The annual funds which are allocated to entrepreneurship educational programs aimed to improve employability of graduates

9.4. Research (MC2) Performance Attributes

The second measurement criterion (research activities) in the previous chapter has been defined in three dimensions and through four indicators. This section provides a detailed view of the attributes in the three dimensions respecting MC2 indicators.

9.4.1. MC2 Performance Attributes – Social Dimension

The social dimension of MC2 has two indicators for the research aspect of VUSR – quality research performance and addressing society's needs and issues through research activities. Each of these indicators has performance attributes, which will be outlined in the following sub-sections.

9.4.1.1. The quality of research performance attributes

As discussed before, quality of research as one of the VUSR indicators for MC2 is measureable through a number of performance attributes. These attributes, as shown in the Table 9.10, constitute applied research projects, the level of research productivity of the university staff (publications) and the research grants provided for students and staff.

Table 9-10 Performance attributes for quality of research performance

Attributes
The number of **applied** research projects
The level of research productivity of the university staff
The number of citations for each staff (**H-index**)
The ratio of **students** who received university **research grants**
The ratio of **staff** who received university **research grants**

9.4.1.2. Addressing society's needs and issues performance attributes

In order to measure university performance in this indicator, i.e. addressing society's needs and issues, a number of attributes are proposed for the VUSR metrics. As Table

9.11 outlines, these performance attributes measure the indicator through the research projects conducted by the VU (staff and research students) to meet society's needs. Society's needs and issues can be addressed in different fields, including local health, K-12 education, cultural identities, industries, economic, environmental, disadvantaged groups and other local infrastructural needs. The university research projects in the above-mentioned areas are regarded as the attributes for the current indicator to measure the social dimension of MC2. For measurement of this indicator, the percentage of university staff involved in community-related research projects as well as the quantity of professional consultations provided for university partners (e.g. industries) are suggested as performance attributes.

Table 9-11 Attributes for commitment to addressing society's needs and issues

Attributes
The percentage of research projects addressing local **health** issues
The percentage of research projects addressing local **K-12 education** problems
The percentage of research projects regarding local **cultural identities**
The percentage of research projects addressing local **industry development**
The percentage of research projects addressing local **economic** issues
The percentage of research projects addressing **sustainable consumption** issues
The percentage of research projects addressing local **environmental issues**
The percentage of research projects addressing other local **infrastructure needs**
The percentage of research projects addressing problems of **disadvantaged groups**

9.4.2. MC2 Performance Attributes – Ethical Dimension

In the VUSR metrics, the ethical dimension of MC2 is anticipated being measured through the university's ethical performance in its research activities. As mentioned before, this indicator mainly refers to the way in which the university appreciates the intellectual property roles in its research mission. As has been shown in Table 9.12, this indicator can be measured by considering the VU policies on intellectual property protection. Another attribute for this indicator is the university's contribution to intellectual property through patenting.

Table 9-12 Attributes for ethical performance in research activities

Attributes	Sub-attributes
Evidence of university **policies** regarding **intellectual property protection**	
The average grade of VU contribution to **intellectual property protection**	

9.4.3. MC2 Performance Attributes – Economic Dimension

As mentioned in the previous section, the annual university expenditure regarding research activities in the context of VUSR is another major indicator for MC2. In the proposed metrics, this indicator will be measured through two sub-indicators. The first is the university's annual funds allocated to improve research performance measured through following performance attributes (see Table 9.13)

Table 9-13 Attributes for annual funds spent on research performance

Attributes
The funds allocated to develop **postgraduate** studies (PhD & Masters)
The funds allocated to **encourage academic staff** to undertake research activities
The funds allocated to research **grants** for university **staff**
The funds allocated to research **grants** for university **students**

The second sub-indicator is the annual funds the university spends on research projects aimed to address society's issues. These projects can be addressing different aspects of society's needs, such as education, health, cultural, economic, environmental, industries, infrastructure, etc. The measurement attributes for this sub-indicator are outlined in the following table.

Table 9-14 Attributes for annual funds to address community needs/issues

Attributes
The funds allocated to research projects addressing **health issues**
The funds allocated to research projects addressing **K-12 education**

The funds allocated to research projects regarding **cultural identities**
The funds allocated to research projects addressing **industries development**
The funds allocated to research projects addressing **economic** issues
The funds allocated to **sustainable environment research projects**
The funds allocated to research projects addressing other **infrastructure needs**
The funds allocated to research projects addressing **disadvantaged groups' issues**

9.5. Service (MC3) Performance Attributes

As defined in the previous chapter, the third measurement criterion (service provision) is measureable in three dimensions through four indicators. This section provides a detailed view of the MC3 attributes in three dimensions respecting the four indicators.

9.5.1. MC1 Performance Attributes – Social Dimension

The social dimension of MC3 has two indicators for the service provision aspect of VUSR – quality and quantity of stakeholders' support services and institutional supports. The first indicator has three sub-indicators including students' support, staff support and support services for other stakeholders. The performance attributes of these indicators follow.

9.5.1.1. Quality and quantity of services for stakeholders

As mentioned in the previous section, the indicator of quality and quantity of service provision for university stakeholders is measureable in three categories – student support services, staff support services and other stakeholders' support services. The details regarding performance attributes on each of these sub-indicators are outlined respectively in the following tables. As can be seen in the Tables 9.15 to 9.17, the evidence or the number of services is the measurement criteria for the quantity aspect, while the quality aspect of service provision is measureable through stakeholders' satisfactions regarding services.

Table 6.16 outlines a number of attributes to be investigated for measurement of the quality and quantity of student support services. As can be seen, these services are divided into two categories – support before registration and support during online study. Each category has a number of performance attributes that show different aspects of student support services.

Table 9-15 Attributes for the quantity and quality of service provision for students

Attributes		**Sub-attributes**
The average grade of **quantity** of **student supports**	Evidence of adequate advisory services before registration to assist students regarding	choosing the course according to their goals and qualifications
		the chosen course requirements (skills)
		the duration, tuition and fees for the chosen course
	Evidence of student support services during their online study	availability of required information (e.g. course information, student support services, etc.)
		clarity of expectations for assignments and assessment policies
		availability of training on how to use and secure material through online databases
		accessibility of technical assistance during the course
		availability of structured systems to receive, consider and address students' complaints
		availability of institutional rewards for effective learning
		availability of encouraging incentives for innovative practices
		accessibility of virtual library/learning resources
		availability of tools/opportunities for student–student collaboration (web conferencing, instant messaging, etc.)
		accessibility of counselling services in personal, academic and career issues
		consultation services provided for students
		supportive plans for entrepreneurship
		the percentage of students who have been supported for their entrepreneurial contributions
The average grade of **quality of support services**	The students' satisfaction of support services received before registration	
	The average grade of students' satisfaction of support services during their studies	availability of course information
		clarity of expectations for assignments and assessments
		training on how to use and secure online material
		technical assistance

		structured systems to address students' complaints
		institutional rewards for effective learning
		encouraging incentives for innovative practices
		virtual library/learning resources
		collaboration tools
		counselling services
		university's supportive plans for entrepreneurship

The second group of performance attributes for the quality and quantity of support services is intended to measure this indicator through support services that the online university provides for its staff. As Table 9.16 shows, the quantity of staff support services will be measured through a number of attributes, such as the percentage of staff receiving different supports (i.e. consultations, promotions, training, etc.). The quality aspect of this sub-indicator is proposed to be evaluated through staff satisfaction regarding the support provided by the university.

Table 9-16 Attributes for quantity and quality of service provision for staff

Attributes	**Sub- attributes**	
The average grade of **quantity** of **staff support services**	The percentage of staff who used university counselling services	
	The percentage of non-academic staff who received skill development training	
	The percentage of staff who received promotions in their position	
	The percentage of staff who have been supported for their entrepreneurial contributions	
The average grade of **quality** of **staff support services**	The average grade of staff **satisfaction** of **support services**	counselling services
		training and skill development programs
		promotion plans and strategies
		supportive plans for entrepreneurship
		university recruitment policies
	The percentage of **non-academic staff** who **remained** for five years or more	

Similarly, the third group of performance attributes for the quality and quantity of support services aims to measure this indicator through support services that the online university provides for other stakeholders. The attributes for measuring quantity and quality of services for other stakeholders are outlined in the following table.

Table 9-17 Attributes for quantity and quality of service provision for others

Attributes	Sub-attributes
The quantity of **service** provision for **external stakeholders**	The percentage of university support services provided for external stakeholders (e.g. other universities' students, K-12 institutions, members of the public, etc.)
The **quality** of **service** provision for **external stakeholders**	The level of satisfaction of external stakeholders about university services provided for them

9.5.1.2. Institutional support services

Institutional support services, as defined earlier, is another aspect of university service provision proposed to be measured through a number of performance attributes. As shown in Table 9.18, the availability of information for university primary stakeholders (current and future students, staff and alumni), evidence of the university's contribution to improving the technological infrastructure and clear analyses of audiences to improve the aspects are attributes for measuring this indicator.

Table 9-18 Performance attributes for institutional support services

Attributes	Sub-attributes
Evidence of the availability of information for primary stakeholders	recent students
	future students
	alumni
	Staff
Evidence of the university's contribution to improving the technology infrastructure through	documented technology plan including security measures (e.g. backup systems, password protection, encryption, etc.)
	centralised system for developing and maintaining virtual education infrastructure
Evidence of regular analyses of audience (needs and issues) for system improvements	

9.5.2. MC3 Performance Attributes – Ethical Dimension

The indicator of ethical performance in service provision is proposed to be measured through the university's contribution in service provision for disadvantaged groups and handicapped students, evidence of fair work practices as well as the university's performance regarding the ethics codes in its practices and procedures (see Table 9.19).

Table 9-19 Attributes for the ethical performance in service provision

Attributes	**Sub- attributes**
The ratio of services provided to disadvantaged groups	
Evidence of fair work practices	equal opportunities (for women and men and young employees)
	recruitment of minority and threatened groups of citizens
	the **ratio** of staff complaints (the number of staff/the number of complaints)
	the **ratio** of students' complaints (the number of students/the number of complaints)

9.5.3. MC3 Performance Attributes – Economic Dimension

As mentioned in the previous section, to measure the economic aspect of service provision, three sub-indicators have been proposed. The first sub-indicator is measuring the annual funds that the online university spends for service provision. Considering three groups of university stakeholders, three criteria have been decided for this sub-indicator as outlined in the following table.

Table 9-20 Performance attributes for the university annual funds spent on the service provision

Attributes	Sub-attributes
The percentage of **funds** allocated to **service** provision for **students**	the percentage of funds allocated to student grants, scholarships and awards*
	the percentage of funds allocated to students from disadvantaged families(e.g. tuition fees, discounts)
	the percentage of funds allocated to support entrepreneurship of students
The percentage of **funds** allocated to **service** provision for **staff**	the percentage of funds allocated to support writers, entrepreneurs, etc.
	the percentage of funds allocated to staff awards and promotion plans*
	the percentage of funds allocated to staff training and skill development programs
The percentage of **funds** allocated to **service** provision for **external stakeholders** (e.g. other universities' students, K-12 institutions, members of the public, etc.)	

9.6. Engagement (MC4) Performance Attributes

In the VUSR measurement framework, the MC4 refers to the engagement aspect which is defined in three dimensions and five indicators. This section provides a detailed view of the attributes of the criterion in social, ethical and economic dimensions respecting the five indicators.

9.6.1. MC4 Performance Attributes – Social Dimension

The social dimension of MC4 has three indicators in the social dimension – teaching/learning, research and service provision. The ethical and economic dimensions of MC4 include one indicator each. These indicators have a number of performance attributes, and in some cases sub-attributes, which will be outlined below.

* Except of research grants funds which are referred to in section 9.3.3.

9.6.1.1. MC4 performance attributes – teaching/learning aspect

As discussed earlier, in order to measure VUSR by MC4, the educational function of the online university and its teaching/learning as an indicator will be investigate to find those contributions that aim to benefit both the university and its community. In the VUSR metrics, this indicator will be measured in two levels of university community engagement, internal and external. For each level a number of sub-attributes have been extracted, as demonstrated in the following table.

Table 9-21 Performance attributes for community engagement through teaching/learning

Attributes	**Sub- attributes**
The level of internal community engagement in T/L	students' involvement with the online discussion board
	instructors' involvement with the online discussion board
	virtual collaborative meetings to address online students' concerns for each unite
	virtual collaborative meetings to address academic staff concerns for each unite
	evidence of regular virtual collaborative meetings to address non-academic staff concerns
	evidence of organised group assignments and presentations for virtual students
	learning modules designed to involve students with workplace practices
	students' engagement in community activities organised by the university
	evidence of annual on-campus conferences for virtual staff
	evidence of annual on-campus conferences for virtual students
The level of external community engagement in T/L	contributions to course provision for employers and their employees
	consultation meetings with employers and other partners on curriculum where relevant
	local employers' involvement in reviewing and developing the content of curriculum
	staff exchanges with other higher education institutions
	university cooperation with other universities to develop undergraduate programs
	university cooperation with other universities to develop postgraduate programs
	workshops run for businesses and industries

	contribution to teaching environmental protection and sustainability to the members of the public
	professional consultations provided to university partners (e.g. industries, etc.); helpdesk facility
	educational programs addressing local skill needs
	units teaching local cultural features and languages

9.6.1.2. MC4 performance attributes – research aspect

In order to measure university community engagement through its research function, the university's research projects in which the university staff and community members have been involved need to be considered. Table 9.22 presents a more detailed view of attributes that need to be considered for measuring university community engagement in research activities.

Table 9-22 Performance attributes for community engagement through research activities

Attributes
University staff involvement in community-related research projects
Community members' involvement in university research projects
Local industries' involvement in university research projects

9.6.1.3. MC4 performance attributes – service aspect

As mentioned in the previous section, the indicators of community engagement through services have two sub-indicators. The first proposed to measure this component investigating the evidence of the online university's contribution to nurturing community sustainability. As shown in the Table 9.23, this contribution can be measured through university policies and practices regarding energy consumption, greater use of resources, quality and safety of services or any attributes that assist in a more sustainable community.

Table 9-23 Performance attributes for university contributions to a sustainable community

Attributes
Evidence of university concerns about energy consumption (energy saving policies and practices)
Evidence of university concerns about using recycled or recyclable products (policies and practices)
Evidence of encouraging the community to greater use of resources (policies and practices)
Evidence of university concerns about the quality and safety of the products and services provided
Evidence of promoting sustainable consumption
Existence of a sustainable development group with members from across services, academic and external relations departments

The second sub-indicator aims to measure the level of university services aimed at community engagement. As mentioned earlier, community here refers to the external community. Table 9.24 outlines a detailed view of the university's performance attributes by which this aspect of community engagement will be measured.

Table 9-24 Performance attributes for services aimed at community engagement

Attributes
The percentage of university resources (library resources, etc.) fostering local cultural identities
Events engaging employers in university activities
The university's contribution to public relationships through media, public lectures, competitions
The university's contribution to improving local employability
The university's contribution to analysing the local context for identifying local needs and issues
Promotion of community engagement through a website and newsletters
Addressing the university's local community needs and issues on the university website
University staff participation in membership of governance entities' board
Rate of existing incentives for staff to engage with business and industry
The level of university collaboration with local cultural institutions

9.6.2. MC4 Performance Attributes – Ethical Dimension

This indicator is proposed to measure the university's contribution to practising and promoting voluntary and charitable activities. This aspect will be measured through a number performance attributes as outlined in Table 9.25.

Table 9-25 Performance attributes for practice and promotion of volunteering

Attributes
The number in the university volunteering and charity services/activities
The percentage of students engaged in volunteering activities organised by the university
The percentage of staff engaged in volunteering activities organised by the university
The rate of existing incentives for students to encourage them in volunteering activities
The rate of existing incentives for staff to encourage them in volunteering activities
The ratio of volunteering against the national average

9.6.3. MC4 Performance Attributes – Economic Dimension

The online university's expenditure on community engagement is proposed to measure the amount of financial resources the university spends on community-related services and activities. This indicator will be measured through a number of attributes outlined in Table 9.26.

Table 9-26 Performance attributes for expenditure on community engagement

Attributes
The annual funds allocated to services/activities fostering local/national cultural identities
The annual funds allocated to volunteering activities
The annual funds allocated to charities and donation practices
The annual funds allocated to improving local employability
The annual funds allocated to improving community sustainability (addressing resource consumption issues)

9.7. Transparency (MC5) Performance Attributes

As discussed in the previous chapter, the MC5 in the VUSR measurement framework refers to transparency, which is defined as the ethical dimension of the social responsibility concept. This criterion has four indicators, each of which includes a number of attributes as outlined below.

9.7.1. MC5 Teaching/Learning Aspect Performance Attributes

The level of online university transparency in teaching/learning processes can be quantified considering different aspects of teaching/ learning. In the VUSR metrics, these aspects are proposed as students' assessment, instructors' evaluation, quality assurance mechanisms, the university policies on publishing students' and instructors' feedback, as well as other types of quality measurement (see Table 9.27).

Table 9-27 Performance attributes for transparency in teaching/learning processes

Attributes
The level of transparency in students' assessment policies
The level of transparency in teachers' evaluation policies
The level of transparency in quality assurance mechanisms
The frequency of publishing of academic staff feedback
The frequency of publishing of students' feedback
The frequency of publishing of the level of academic performance quality
The frequency of publishing of national university ranking results (teaching ranking)

9.7.2. MC5 Research Aspect Performance Attributes

In order to measure university transparency in research activities, the criteria such as frequency of publishing funding sources at different levels, as well as research quality measurement results, and the university ranking results have been proposed. Table

9.28 presents a detailed view of performance attributes by which this criterion will be measured.

Table 9-28 Performance attributes for transparency in research activities

Attributes	Sub-attributes
The frequency of publishing internal research funding distribution (at university, faculty, school, department levels)	
The frequency of publishing external grants from government, industry, etc. (at university, faculty, school, department levels)	
The frequency of publishing research quality measurement results	
The frequency of publishing the quality of academics' research performance	
The frequency of publishing the national university ranking results (research ranking)	

9.7.3. MC5 Services Aspect Performance Attributes

The transparency in services also is measureable through a number of performance attributes, such as university policies on publishing the information regarding the available support services for different stakeholders, their satisfaction with the services provided and updates on staff contact information. The detailed view of attributes for this criterion is shown in Table 9.29.

Table 9-29 Performance attributes for transparency in services

Attributes
The level of transparency in the university support services for students
The level of transparency in the university support services for staff
The frequency of publishing student satisfaction with university services
The frequency of publishing staff satisfaction with university services
The frequency of publishing the university's financial support services provided for students
The frequency of publishing the university's financial support services provided for staff
The frequency of publishing/updating the staff list and contact information (at university, faculty, school, department levels)

9.7.4. MC5 Governance Aspect Performance Attributes

The last indicator of the proposed metrics, i.e. transparency in governance, has a number of performance attributes which enable the metrics to measure the level to which the university stakeholders (e.g. community) can be informed of and contribute to the VU governing system. The number of stakeholders (e.g. students and community members) who attend as the board members, the average grade of staff and students' satisfaction with the university's openness in its governance policies and the frequency of publishing regarding the governance structure are some of attributes for the current indicator. More details on performance attributes for measuring the university's transparency in governance is presented in the table below.

Table 9-30 Performance attributes for transparency in governance

Attributes
The percentage of university board members who are from the campus community (i.e. students)
The percentage of university board members who are from the local community (e.g. industries, businesses)
The level of the university's communication to its stakeholders (e.g. students, employees, local authorities, etc.)
The average level of students' satisfaction with access to accurate information regarding the university's governance policies
The average level of staff satisfaction with access to accurate information regarding the university's governance policies
The frequency of publishing of the university's annual reports during the last six years
The frequency of publishing updates regarding the governing structure of the university
The frequency of publishing updates regarding the management structure of the VU (at university, faculty, school, department levels)
The frequency of publishing updates regarding board members

9.8. Conclusion

In this chapter, the researcher outlined the detailed levels of the VUSR measurement framework. Considering the hierarchical structure for measurement of this concept, the five main VUSR measurement criteria have been defined through their attributes in this chapter. These attributes have been organised based on dimensions of the social responsibility concept and with respect to the indicators of the measurement criteria. Although the current chapter represented a detailed view regarding the VUSR measurement framework, the measurement approach still needs to be clarified. The method in which these criteria should be employed, the degree of influence of each measurement criterion on the VUSR score and the scale of this measurement are important components that need to be explained. Therefore, the following chapters of this thesis are organised to provide details for the measurement techniques and approach.

Chapter 10_ An AHP-based Technique for the Virtual University Social Responsibility Measurement

10.1. Introduction

In the previous chapters, based on the ontology of the VUSR concept, a measurement framework was outlined. As this concept is inherently complex, it is necessary to measure it in different dimensions. Therefore, the VUSR measurement dimensions as well as their indicators have been considered and the researcher came up with a VUSR measurement framework with five major aspects (criteria) and 22 indicators (sub-criteria). In this chapter, an AHP approach will be considered and the relative measurement model for VUSR evaluation will be presented. The proposed model will use a case study for more identification.

In this chapter, the AHP approach for measuring the concept of VUSR will be discussed in section 10.2 and the reasons why the approach has been chosen will be presented in section 10.3. In section 10.4, according to the chosen approach, a relative measurement model will be proposed which can be used for comparing different VUs based on their commitment to VUSR. Different components of the approach will be defined and different scenarios for the application of this approach will be discussed through a case study. The last section of this chapter is the conclusion.

10.2. Analytical Hierarchy Process (AHP) for Measuring VUSR

There are different approaches for employing the identified measurement criteria and accordingly quantifying the concept of VUSR. Considering VUSR as a kind of human

performance and bearing in mind that its measurement involves decision-making and human judgment, the AHP approach can assist the researcher in making appropriate decisions in the measurement process. Specifically, the AHP approach is helpful in determining the degree of importance of each measurement criterion and comparing different universities based on the criteria.

The AHP is a hierarchical model in which several levels represent the system elements, consisting of goal, clusters, sub-clusters (e.g. criteria, attributes, etc.). The main focus of this approach is on the way in which the human mind organises the required data for decision-making. The AHP technique, through a pairwise comparison among the different measurement criteria, can assist a researcher in determining the importance of each criterion with respect to the goal. The implementation of this approach requires three main components, a goal, different criteria (parameters) to achieve the goal and a number of alternatives to choose from. AHP consists of three main steps:

1. Development of the hierarchy of attributes
2. Identification of the relative importance of each criterion (weight value)
3. Computing the score of each alternative's relative performance on each criterion.

The essence of the mathematics of AHP is to establish a matrix indicating the relative values of a set of criteria or attributes. This can be achieved by developing the pairwise comparison matrixes, which is a common approach in identifying the preference, dominance or importance of entities in pairs by comparing them head to head with respect to a certain attributes or criterion.

10.3. Why use AHP for VUSR measurement?

It has been said that measurement is a quantitative description of the real world in which, based on an objective, numbers or symbols can be assigned to the attributes of objects or events (Finkelstein, 1994). Considering the distinctions between

measurements in physics and in human actions, when we are measuring human performance, we strive to arrange human actions with respect to priorities. The process of measurement, especially in the case of subjective concepts such as social responsibility, involves decision-making in many different moments. Identification of the main criteria by which a concept can be measured and also determining the relative importance of the criteria are examples of decisions that need to be made with a scientific approach. Obviously, the decision-making in such a situation is closely involved with the human judgment.

As mentioned by Saaty (2004), all kinds of judgments in the human mind, including 'comparative' and 'absolute' judgments, involve making comparisons. This means we understand everything in relation to other things. The challenge here is how the judgments can be made reliably, as these are the bases of human decisions. Another question that might be raised here is where there are different scales for measuring with respect to a variety of criteria and sub-criteria, and how these scales can be synthesised to obtain a general relative scale. Saaty (2004) addresses these sorts of questions and argues that the best solution is to develop a relative scale for the measurement criteria regarding the measurement goal and also comparing the alternatives with respect to the criteria through the relative scales.

In the current research, the AHP approach as proposed by Saaty (1980, 2004, 2008) can help the researcher develop such a scale for measuring VUSR. In this approach, using a qualitative procedure, an unstructured problem can be decomposed into a structured hierarchy. Therefore, implementing AHP, a structured hierarchy can be developed by which the important elements of measuring VUSR will be organised. Quantitatively, AHP employs pairwise comparisons enabling the researcher to carry out consistency tests in order to validate the consistency of results. In the case of measuring VUSR, after structuring the systematic hierarchy, the measurement criteria will be prioritised and ranked with respect to the objective through pairwise comparison. In the case where there are a number of VUs, this technique also assists in ranking the universities with respect to the measurement criteria.

To measure the concept of VUSR, two measurement methods can be employed, relative (comparative) measurement and absolute measurement. In the first approach,

with respect to the goal, the VUSR criteria should be pairwise compared, then the alternatives (different VUs) with respect to each criterion have to be pairwise compared and the results should be synthesised to give the overall ranking of the VUs in regard to their social responsibility. In the second approach, i.e. absolute measurement, the standards for each VUSR evaluation criterion should be established and then VUs should be rated one by one against the standards rather than being compared with each other. Both relative and absolute measurement methods are achievable through AHP techniques (Saaty, 2004). As this thesis aims to develop the VUSR measurement framework, the relative measurement approach has been selected. The reasons behind this choice are as follows:

- The main subject of this measurement, i.e. social responsibility, is involved with human performance and consequently is subjective. The measurement of such a concept is involved with decision-making and comparisons (e.g. which criterion has more priority). The AHP facilitates these functions in scientific methods which results in deriving a relative measurement scale.

- There is not enough background for the VUSR measurement scale to help the researcher to establish the measurement criteria standards, therefore, the absolute measurement method cannot be employed.

10.4. Relative Measurement Model for VUSR Evaluation in AHP

Considering the above discussion, the relative AHP model will be employed for the first step of the measurement approach, which is to develop the hierarchy of measurement attributes. Therefore, the relative measurement model VUSR has been constructed, as outlined in Figure 10.1.

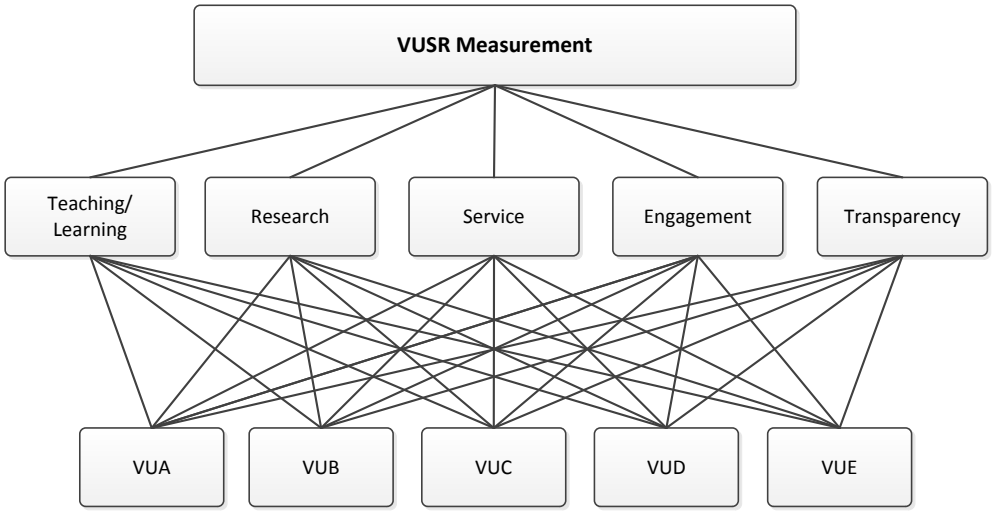


Figure 10-1 The relative model for VUSR measurement comparing five virtual universities

According to this model, there are five dimensions (main criteria) for measuring VUSR which are proposed to be measured considering five alternatives, i.e. different virtual universities named A to B (see Table 10.1). The criteria identified through a thorough literature review and the content analysis process using the body of knowledge in the field of USR.

Table 10-1 The VUSR measurement criteria and the alternatives list

VUSR Measurement Criteria	VUs/Alternatives
Teaching / Learning	VUA
Engagement	VUB
Transparency	VUC
Service	VUD
Research	VUE

In the AHP approach, after developing the hierarchy of measurement attributes, the relative importance of each criterion needs to be identified. Therefore, the criteria have been considered to give a weighting (level of importance) to each criterion. As mentioned before, these criteria have been extracted through the content analysis process. Hence, the content analysis results obtained from NVivo can be helpful to see the initial weighting of each parameter. The word frequency analysis results have been revealed in Chapter 5 to demonstrate the most frequent terms in the context of USR. One of the results obtained from the NVivo analysis regarding each

term is the weighted percentage of the word in the context (see Tables 5.2 and 5.6). The weighted percentage shows the frequency of the words (concepts) relative to the total words (concepts) counted. For the purpose of this chapter, the weighted percentage of each measurement criterion, including its related terms, has been taken from the content analysis results in NVivo (see Table 10.2).

Table 10-2 The USR criteria weighting obtained from NVivo analysis

USR Dimensions (Criteria)	Weighted Percentage	Normalised Weights
Teaching/learning (T/L)	4.14	0.444822
Engagement	2.77	0.297622
Research	1.32	0.141827
Service	1	0.107445
Transparency	0.0771	0.008284

The above table presents the weighted percentage of each factor considering its occurrence in the literature of USR. The third column demonstrates the normalised values obtained through dividing each element in the second column by the sum of this column. These results need to be modified, which will be discussed below.

Firstly, although the literature analysis provides a valuable groundwork which assists the researcher in finding the value of importance for the four measurement criteria, the literature analysis cannot be helpful regarding the last criterion, i.e. 'transparency'. As discussed in Chapter 6, transparency has been recognised as the missing factor of USR in the analysed body of knowledge. However, as this criterion has been known as one of the major aspects of CSR, it has been included in the USR ontology, which is the source of VUSR measurement framework. It is worth being reminded that in this research, CSR is the basic concept for USR/VUSR. As the criterion transparency has been recognised as a missing concept in the analysed literature, its weight is very low (0.000192). Considering this, it can be understood that the obtained weight for this criterion (transparency) needs to be changed based on its importance in the context.

Secondly, the criterion 'research' in the context of USR is the third factor in regards to importance. The reason is that 'research' is the second mission of higher

education institutions and the second major function of universities. However, the researcher is aware that when it comes to the online/virtual university context, its importance is not as high as conventional universities. As discussed in the literature (Chapter 2), online and virtual universities have emerged mostly to extend the accessibility of educational opportunities. Hence, for further analysis in measuring VUSR, the importance of this factor needs to be decreased.

Thirdly, as mentioned before, these criteria will be compared against each other in the AHP approach, and the primary condition for the pairwise comparison is that the sets must be homogeneous. This means that the importance of the largest object must not be more than nine times the smallest (Saaty, 2008). In the other words, the widest acceptable span is a range of 1 to 9. However, as Table 7.2 shows, the criterion teaching/learning according to the analysed literature is around 57 times greater than the criterion transparency. These sorts of differences must be modified according to the context.

Based on the above-mentioned reasons, the weighting of some criteria has been modified considering the context of virtual education and the literature of USR and CSR. In this modification, the criterion research and the criterion transparency have been replaced with each other. Then, in order to homogenise the sets, the largest value is divided by 9 to obtain the smallest value. The results have been normalised as mentioned earlier, therefore the total importance value equals 1 (see Table 10.3).

Table 10-3 The VUSR criteria weighting according to NVivo results with modifications

VUSR Measurement Criteria	Importance Weight
Teaching / Learning	0.445
Engagement	0.298
Transparency	0.142
Service	0.107
Research	0.049

10.4.1. Pairwise Matrix Creation

In order to determine the relative importance of the five major criteria, a 5×5 matrix was formed. In this matrix (Table 10.4), the criteria in the left column are compared one by one with the criteria in the top row in order to see which criterion is more important in regards to the goal. For each position in this matrix, the weight of the VUSR factor at the left is compared with the weight of the VUSR factor at the top and the ratio is calculated. Therefore, each number shows how many times the VUSR factor in the left column is preferable to the VUSR factor in the top.

Table 10-4 The VUSR factors' relative importance pairwise comparison matrix

Goal	T/L	Engagement	Transparency	Service	Research
T/L	1.000	1.493	3.134	4.159	9.082
Engagement	0.670	1.000	2.099	2.785	6.082
Transparency	0.319	0.477	1.000	1.327	2.898
Service	0.240	0.359	0.754	1.000	2.184
Research	0.110	0.164	0.345	0.458	1.000

The dominance of each criterion is calculated with respect to the goal by dividing the normalised value in each the eigenvector by the total value of its elements. Table 10.5 shows the dominance of each VUSR criterion for measuring the concept.

Table.10-5 The priority vectors (criteria weighting with respect to the goal)

Criteria	Priority
T/L	0.427
Engagement	0.286
Transparency	0.136
Service	0.103
Research	0.047

Once the value of priority of each criterion has been identified, the score of each alternative relative performance on each criterion needs to be calculated. This study has not aimed to collect real data regarding VUs, so a case study has been run for this step. In the case study, five different VUs (A to E) are pairwise compared head to head with respect to the criteria. The comparisons have been made by a number of

experts in the field through Expert Choice 11.5 Software©. The normalised judgments for each VU regarding the VUSR criteria is presented in the following table (see Table 10.6).

Table 10-6 Normalised alternatives' values with respect to each criterion

Goal	T/L	Engagement	Transparency	Service	Research
VUA	0.143	0.293	0.079	0.219	0.161
VUB	0.229	0.185	0.249	0.156	0.239
VUC	0.217	0.231	0.209	0.262	0.248
VUD	0.319	0.184	0.283	0.196	0.282
VUE	0.093	0.106	0.181	0.168	0.07

Table 10.7 presents the pairwise comparisons of alternatives with respect to each criterion and the derived priorities in each of the criteria.

Table 10-7 The alternatives' priorities with respect to each criterion

T/L	VUA	VUB	VUC	VUD	VUE	Priorities
VUA	1.000	0.624	0.659	0.448	1.538	0.143
VUB	1.601	1.000	1.055	0.718	2.462	0.229
VUC	1.517	0.948	1.000	0.680	2.333	0.217
VUD	2.231	1.393	1.470	1.000	3.430	0.319
VUE	0.650	0.406	0.429	0.292	1.000	0.093
Engagement	**VUA**	**VUB**	**VUC**	**VUD**	**VUE**	**Priorities**
VUA	1.000	1.584	1.268	1.592	2.764	0.293
VUB	0.631	1.000	0.801	1.005	1.745	0.185
VUC	0.788	1.249	1.000	1.255	2.179	0.231
VUD	0.628	0.995	0.797	1.000	1.736	0.184
VUE	0.362	0.573	0.459	0.576	1.000	0.106
Transparency	**VUA**	**VUB**	**VUC**	**VUD**	**VUE**	**Priorities**
VUA	1.000	0.317	0.378	0.279	0.436	0.079
VUB	3.152	1.000	1.191	0.880	1.376	0.249
VUC	2.646	0.839	1.000	0.739	1.155	0.209
VUD	3.582	1.137	1.354	1.000	1.564	0.283
VUE	2.291	0.727	0.866	0.640	1.000	0.181

Service	VUA	VUB	VUC	VUD	VUE	Priorities
VUA	1.000	1.404	0.836	1.117	1.304	0.219
VUB	0.712	1.000	0.595	0.796	0.929	0.156
VUC	1.196	1.679	1.000	1.337	1.560	0.262
VUD	0.895	1.256	0.748	1.000	1.167	0.196
VUE	0.767	1.077	0.641	0.857	1.000	0.168

Research	VUA	VUB	VUC	VUD	VUE	Priorities
VUA	1.000	0.674	0.649	0.571	2.300	0.161
VUB	1.484	1.000	0.964	0.848	3.414	0.239
VUC	1.540	1.038	1.000	0.879	3.543	0.248
VUD	1.752	1.180	1.137	1.000	4.029	0.282
VUE	0.435	0.293	0.282	0.248	1.000	0.070

10.4.2. Synthesising the Results

The priority vectors, which are the main eigenvector of the pairwise comparison matrices, have been normalised by dividing each component of the main eigenvector by the sum of its components (rows), so their total value would be 1. This means they are in distributive forms. Table 7.8 shows the overall priorities for the alternatives in the distributive form. The values here obtained from the priority column in the matrices presented in Table 10.7. In the following tables (10.8 and 10.9), the total weights calculated by multiplying each element in the row by its dominance (importance weight) and summing by the total elements. The overall priority vector in the following tables is the normalised form of the total vector, i.e. each element in the total vector is divided by the sum of this vector. Figure 10.2 illustrates the visual representation of criteria priorities in distributive form.

Table 10-8 The obtained overall priorities for the alternatives using the distributive form

Synthesis	T/L	Engagement	Transparency	Service	Research	Total	Overall Priority
	0.427	0.286	0.136	0.103	0.047	Weight	Normalized Total
VUA	0.143	0.293	0.079	0.219	0.161	0.157	0.187
VUB	0.229	0.185	0.249	0.156	0.239	0.202	0.211
VUC	0.217	0.231	0.209	0.262	0.248	0.213	0.225
VUD	0.319	0.184	0.283	0.196	0.282	0.256	0.260
VUE	0.093	0.106	0.181	0.168	0.07	0.106	0.117
Inconsistency 0.01							

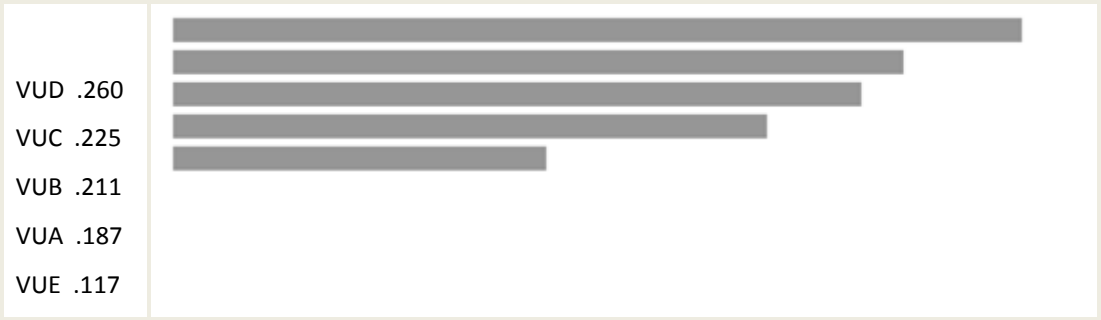


Figure 10-2 Synthesised results in the distributive form (overall inconsistency 0.01)

As the distributive and ideal modes are both necessary in AHP (Saaty, 2004), in the next step to obtain the idealised form of the priority vectors, the largest component in each vector has been selected and all the components have been divided by it. Table 10.9 shows the idealised form of the priority vectors with respect to each criterion. The visualisation of obtained priorities in this mode is presented in Figure 10.3.

Table 10-9 The obtained overall priorities for the alternatives using the idealised form

Synthesis	T/L	Engagement	Transparency	Service	Research	Total	Overall Priority
	0.427	0.286	0.136	0.103	0.047	Weight	Normalized Total
VUA	0.448	1.000	0.279	0.836	0.571	0.534	0.188
VUB	0.718	0.631	0.880	0.595	0.848	0.675	0.210
VUC	0.680	0.788	0.739	1.000	0.879	0.721	0.226
VUD	1.000	0.628	1.000	0.748	1.000	0.854	0.257
VUE	0.292	0.362	0.640	0.641	0.248	0.362	0.119
Inconsistency 0.01							

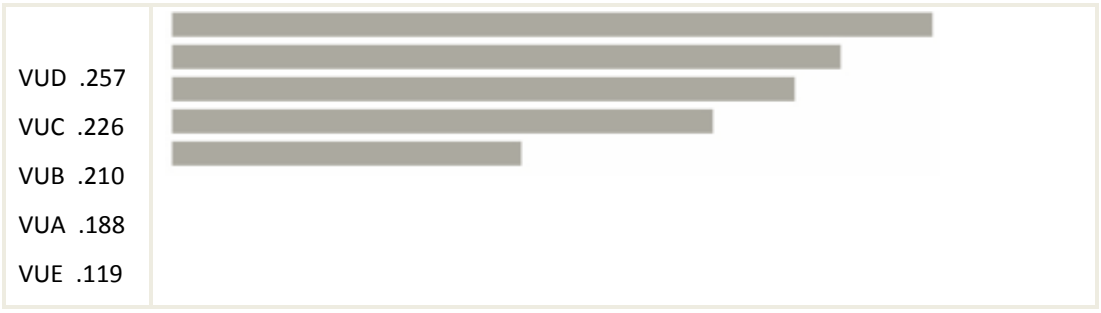


Figure 10-3 Synthesised results in the ideal form (overall inconsistency 0.01)

As the results show, the overall priorities in the ideal form are somewhat different, however the order of VUs are the same in both synthesis forms. The most socially responsible VU with either form of synthesis is the university labelled D according to the judgments. And the ranking of evaluated VUs with respect to their social responsibility is as follows: D, C, B, A and E. The ratios in both distributive and ideal modes are meaningful; this shows that university D has twice the social responsibility than university E.

The performance of universities in different criteria is another worthwhile output that the synthesis provided for the researcher (see Figure 10.4). As the figure illustrates, although university D is ranked as the most socially responsible university, with respect to the second measurement criteria (i.e. engagement) it is not as high as universities A and C. Similarly, although university A has been recognised as very low in the third criteria (transparency), in regard to the second criteria it has been recognised as very high. Figure 10.4 represents the visualisation of how different alternatives performed in each criterion in comparison to the other criteria.

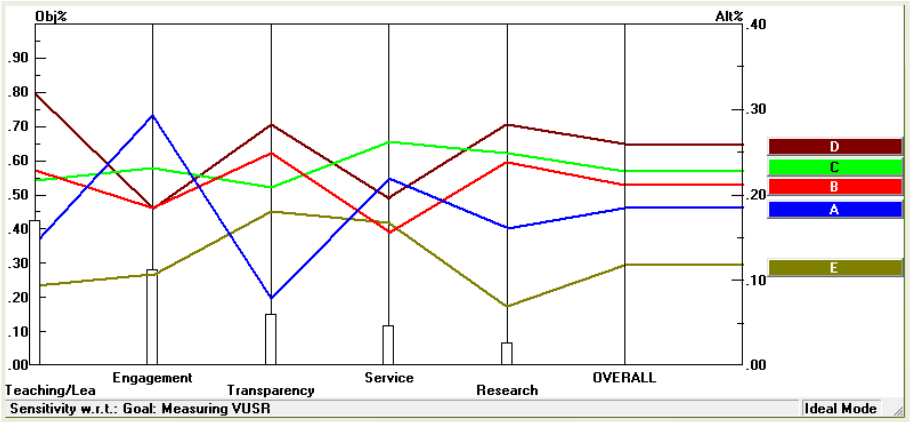


Figure 10-4 Performance sensitivity of nodes

The performance sensitivity graph generally shows that there are fluctuations in all universities' performance in different VUSR factors except for university C where there is a consistency in regard to its performance in different criteria. The graph also shows that according the judgments, university D has the highest score in teaching/learning, transparency and research, however, in regard to service provision, the university C has the highest score, and for the criterion engagement the highest score belongs to university A.

10.4.3. Sensitivity Analysis

In the last step of AHP analysis in this research, to examine the impact of changing the priority of the VUSR criteria on the VUs' rates, a series of sensitivity analyses were performed using Expert Choice 11.5©. Through the dynamic sensitivity analysis, the priority value of each criterion was changed to determine its impact on weightings allocated to criteria further down the hierarchy. Figure 10.5 shows the original scenario based on the importance values obtained in the AHP approach. As can be seen, on the left side, measurement criteria according to their priorities have been illustrated and on the right side the universities and their rates in VUSR have been displayed.

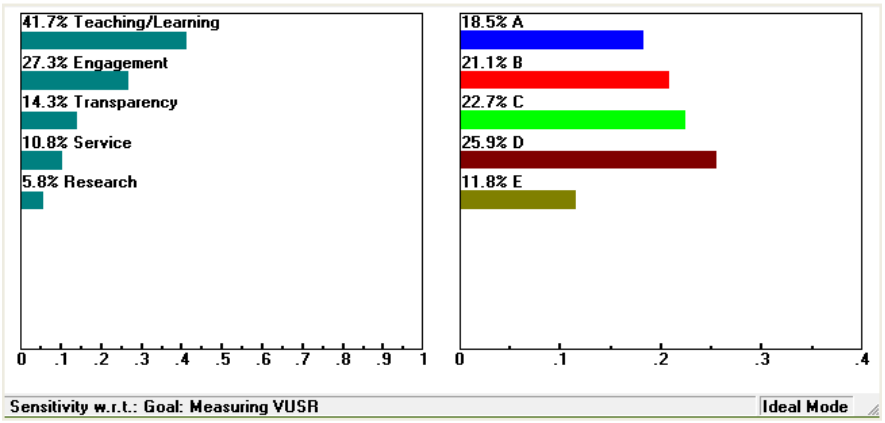


Figure 10-5 Dynamic sensitivity analysis (original scenario)

In order to examine the sensitivity analysis in cases where the priority of engagement has been changed, the priority of this factor has been increased from 27.3 to 40.6 (see Figure 10.6). As can be seen in the below graph, although increasing the value of the engagement criterion has decreased the distances between universities, it has no effect on the ranking of alternatives.

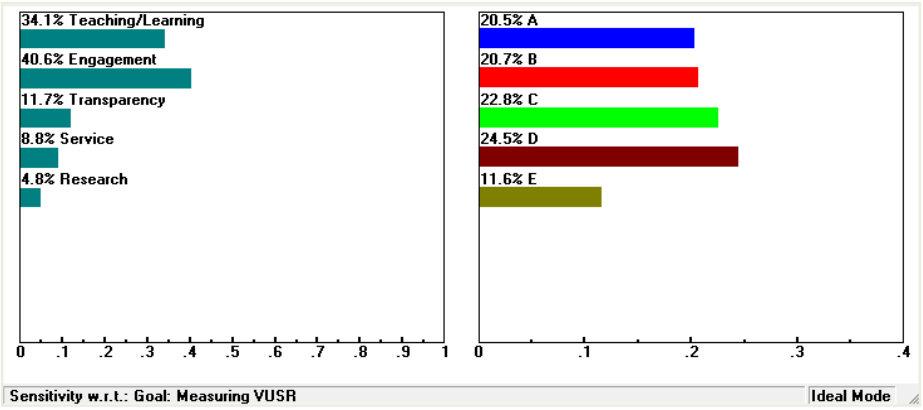


Figure 10-6 Dynamic sensitivity analysis with the adjustment on 'engagement'

For the next case, the value of transparency criterion has been changed to consider it as the first priority in VUSR measurement. This criterion has 14.3% priority in the original scenario. If this value rises to 35.7 %, then the values for other criterion will change to the numbers shown in Figure 10.7. Interestingly, the overall priorities of alternatives are same as the original scenario.

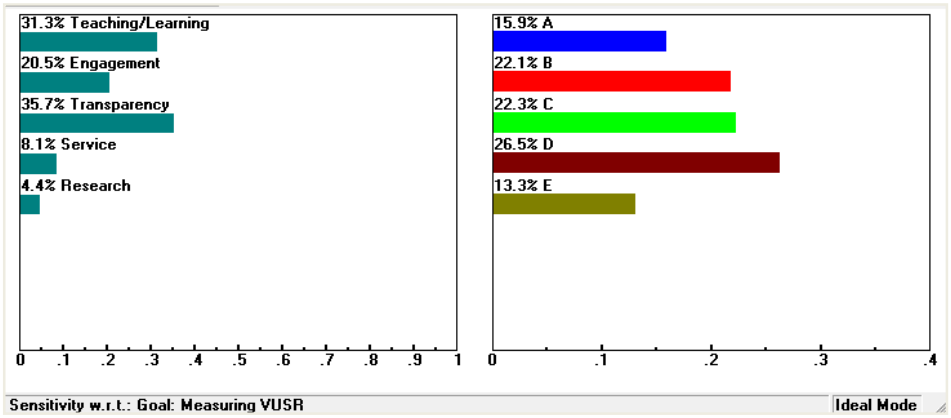


Figure 10-7 Dynamic sensitivity analysis with the adjustment on "transparency"

The dynamic sensitivity analysis was carried out by creating small variations in all the weights to see if the decision will change. These analyses reveal that the VUs' rankings were relatively insensitive to the small changes in the importance of the VUSR criteria. This reassures that the overall results in this case study are fairly stable and reasonable.

In this section, the researcher tried to make use of content analysis results directly with some modifications to determine the degree of importance of each measurement criteria for the relative measurement approach in AHP. The values used in this approach were crisp values, as the results obtained from the literature content analysis appeared in this format. However, a fuzzy concept such as social responsibility and the judgments around its measurement also need to be considered using fuzzy techniques. Therefore, the next section of this chapter aims to outline the fuzzy techniques that seem to be helpful for a more reliable measurement approach.

10.5. Conclusion

In this chapter, the applicability of the AHP approach for measuring the social responsibility of VUs has been discussed. Section 10.3 discussed the reasons why AHP can be employed for the VUSR measurement. Then, the relative measurement model for VUSR evaluation in AHP was proposed in section 10.4. The proposed model was tested through a case study in which all the judgments are relative rather than absolute. The approach could be useful, once the purpose is comparing and ranking online universities based on their commitment to social responsibility using the experts' points of view. The researcher illustrated some of capabilities of the Expert Choice software, such as sensitivity analyses for examining different possible results based on the priorities of the measurement criteria.

Chapter 11_ A Fuzzy-based Analytics for Measurement of Virtual University Social Responsibility

11.1. Introduction

In this chapter, a fuzzy AHP approach which aims to consider the fuzziness of the VUSR measurement criteria (section 11.3) will be outlined. The purpose of using this approach is to determine the level of importance of each measurement criterion considering the vagueness and fuzziness of the criteria. This approach will be extended in section 11.4 by using another fuzzy ANP approach that is intended to consider the interrelationships among the measurement criteria to identify the significant value for each criterion. Once the significance value of each criterion considering the fuzziness as well as the dependencies among the measurement criteria has been determined, a fuzzy logic-based VUSR metrics will be proposed in section 11.5. The metrics based on the VUSR measurement framework is comprised of all the VUSR measurement criteria and sub-criteria. It also contains a number of measurement scales which are appropriate for a variety of variables of VUSR sub-criteria. These scales will be outlined in section 11.6 in two groups of linguistic and numeric scales alongside their corresponding fuzzy triangular scale. As the final aggregated score of VUSR needs to be converted back to a non-fuzzy value, the defuzzification method which suits the proposed metrics will be defined in section 11.7, which will be followed by the conclusion.

11.2. Fuzzy Analytical Hierarchy Process (AHP) and Fuzzy Analytical Network Process (ANP) for Measuring VUSR

In this chapter, instead of the conventional AHP approach, another approach will be employed to identify the significance value of the VUSR measurement criteria. There are many different approaches in the literature to find this value. In the current research, the extent analysis method proposed by Chang (1996) has been chosen. The extent analysis method is a fuzzy AHP approach by which a crisp priority vector for the measurement criteria can be obtained using a triangular fuzzy comparison matrix. This approach has also been used by a number of scholars such as Yuksel and Dagdeviren (2010) and Hussain, Sangka, and Hussain (2012) in order to obtain the importance value of the assessment criteria through the triangular fuzzy comparison matrix. After identification of the priority vector (importance value) of measurement criteria, as there are some dependencies between the VUSR criteria, a fuzzy ANP approach will be used to identify the measurement criteria's significance values considering their interdependencies.

11.3. Fuzzy Analytical Hierarchy Process (AHP) to Determine the Significance of the Measurement Criteria

Although AHP has been applied as a powerful and flexible technique to deal with complex problems in a variety of contexts, it may not be reliable enough for some multi-criteria decision-making situations (Lu et al. 2007). The main feature of these situations is associated with fuzziness and vagueness of the criteria. Complexity in identification of consistency of preferences, the uncertainty in the preference judgments and, therefore, unreliability of the alternatives' rankings are discussed by scholars as considerable issues when using AHP (Leung & Cao, 2000). Fuzzy AHP, which is an extension of AHP technique, has been developed to address these issues. Researchers have compared fuzzy AHP with the classic AHP and argued that the new approach can generate more precise and reliable results (Ozdagoglu & Ozdagoglu, 2007).

Recently, Lin (2010) applied the fuzzy AHP technique to develop an evaluation model identifying the relative importance of the course website quality factors. Mikhailov and Tsvetinov (2004) used the same approach to overcome uncertainty in the service evaluation process. Applying fuzzy AHP, Yang and Chen (2010) proposed an evaluation model to determine the key factors of quality performance. There are a number of references where fuzzy AHP has been employed for personnel selection (Gungor, Serhadlıoglu, & Kesen, 2009), research and development project selection (Mohanty, Agarwal, Choudhury, & Tiwari, 2005), identification of significant value of customer requirements (Kwong & Bai, 2010), and so on. There are a variety of fuzzy AHP models, Buckley (1985), Chang (1996), and Leung and Cao (2000) are some examples of these models. In this research, the extent analysis method proposed by Chang (1996) will be employed because of its popularity and simplicity. The approach has been applied by a number of scholars such as Kahraman, Ertay, and Buyukozkan, (2006) and Hussain et al (2012).

The fuzzy AHP approach to determine the significance of the VUSR measurement criteria in this research includes five steps:

1. development of the hierarchy of the goal and the criteria
2. identification of a linguistic scale for measuring the relative significance of the assessment criteria
3. identification of a triangular fuzzy scale representing the range of fuzzy sets for the linguistic scale and the triangular fuzzy reciprocal values for this scale
4. development of the pairwise comparison matrix for the VUSR measurement criteria with respect to the goal
5. application of the fuzzy synthetic extent approach to identify the degree of the possibility of each measurement criterion.

The results of these analyses will be the degree of significance for each assessment criterion with respect to measuring VUSR. In this section, these steps with the corresponding results will be explained.

First step: Developing the hierarchy of the goal and criteria, which includes five main criteria: teaching/learning, engagement, transparency, services, and research (Figure 11.1).

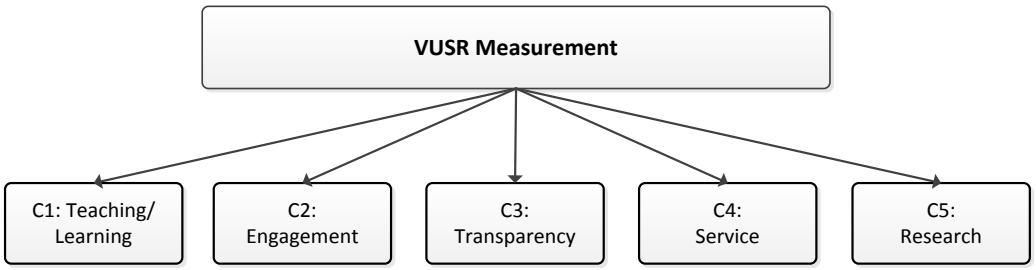


Figure 11-1 The measurement criteria with respect to the goal

Second step: Defining the linguistic range to specify the different levels of importance. The linguistic scale by which the significance value of VUSR criteria will be identified is shown in Figure 11.2 and consists of six levels of importance.

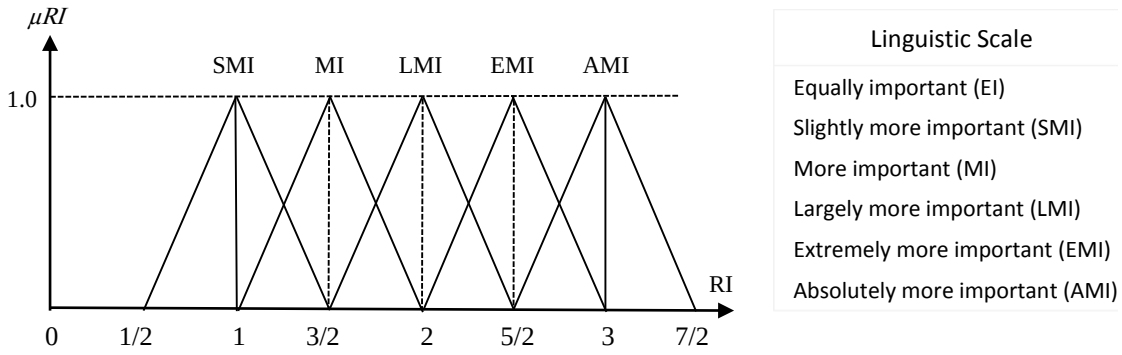


Figure 11-2 The linguistic scale for assessing the significance of the measurement criteria

Third step: Determining a triangular fuzzy scale to identify different fuzzy sets of importance and the triangular fuzzy reciprocal value for the different linguistic fuzzy sets (see Table 11.1). In this scale, employing the fuzzy sets with membership functions enables the researcher to assign a degree of membership to the measurement criteria by which the uncertainty of judgments would be captured. Fuzzy sets as defined by Zadeh (1965) are classes of objects with a continuum of degrees of memberships.

Table 11-1 The linguistic scale and triangular fuzzy scale for significance of the criteria

Linguistic Scale for Importance	Triangular Fuzzy Scale	Triangular Fuzzy Reciprocal
Equally important (EI)	(1,1,1)	(1,1,1)
Slightly more important (SMI)	(1/2, 1, 3/2)	(2/3, 1, 2)
More important (MI)	(1, 3/2, 2)	(1/2, 2/3, 1)
Largely more important (LMI)	(3/2, 2, 5/2)	(2/5, 1/2, 2/3)
Extremely more important (EMI)	(2, 5/2, 3)	(1/3, 2/5, 1/2)
Absolutely more important (AMI)	(5/2, 3, 7/2)	(2/7, 1/3, 2/5)

A TFN, as outlined in Figure 11.3, has three parameters *l*, *m*, and *u*, of which the component *l* represents the smallest possible value; *m* stands for the highest possible value and *u* denotes the largest possible value ($l \leq m \leq u$).

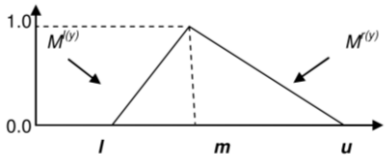


Figure 11-3 A triangular fuzzy number $\widetilde{M}$

Fourth step: Developing 5 x 5 matrix to pairwise compare the measurement criteria with respect to the goal of this study (see Table 11.2).

Table 11-2 The VUSR factors' relative importance fuzzy pairwise comparison matrix

VUSR Assessment	C1	C2	C3	C4	C5
C1	(1,1,1)	(1, 3/2, 2)	(1, 3/2, 2)	(2, 5/2, 3)	(5/2, 3, 7/2)
C2	(1/2, 2/3, 1)	(1,1,1)	(1, 3/2, 2)	(2, 5/2, 3)	(5/2, 3, 7/2)
C3	(1/2, 2/3, 1)	(1/2, 2/3, 1)	(1,1,1)	(3/2, 2, 5/2)	(5/2, 3, 7/2)
C4	(1/3, 2/5, 1/2)	(1/3, 2/5, 1/2)	(2/5, 1/2, 2/3)	(1,1,1)	(3/2, 2, 5/2)
C5	(2/7, 1/3, 2/5)	(2/7, 1/3, 2/5)	(2/7, 1/3, 2/5)	(2/5, 1/2, 2/3)	(1,1,1)

In this matrix, the criteria in the left-hand column are compared one by one with the criteria in the top row in order to determine, in regard to the goal, which criterion is more important. In the matrix, to compare each criterion against other criteria, the triangular fuzzy scale has been employed. The assigned fuzzy numbers in this matrix

are according to the recognised level of importance for the criteria in the previous approach.

Fifth step: Determination of the degree of possibility in which a given measurement criterion is more important than the others by using the fuzzy synthetic extent approach. In this step, to calculate the significance value for each measurement criterion, the following formula proposed by Chang (1996) has been used.

$$\begin{aligned} P(V_1 \geq V_2) &= 1 \quad \text{if } m_1 > m_2 \text{ or} \\ P(V_1 \geq V_2) &= 0 \quad \text{if } l_2 > u_1 \text{ otherwise} \\ P(V_1 \geq V_2) &= \frac{l2-u1}{(m1-u1)-(m2-l2)} \end{aligned} \qquad \textbf{(1)}$$

Table 11-3 The importance value of VUSR measurement criteria

AC	C1	C2	C3	C4	C5	Significance Value
C1	(1,1,1)	(1, 3/2, 2)	(1, 3/2, 2)	(2, 5/2, 3)	(5/2, 3, 7/2)	0.361
C2	(1/2, 2/3, 1)	(1,1,1)	(1, 3/2, 2)	(2, 5/2, 3)	(5/2, 3, 7/2)	0.323
C3	(1/2, 2/3, 1)	(1/2, 2/3, 1)	(1,1,1)	(3/2, 2, 5/2)	(5/2, 3, 7/2)	0.140
C4	(1/3, 2/5, 1/2)	(1/3, 2/5, 1/2)	(2/5, 1/2, 2/3)	(1,1,1)	(3/2, 2, 5/2)	0.118
C5	(2/7, 1/3, 2/5)	(2/7, 1/3, 2/5)	(2/7, 1/3, 2/5)	(2/5, 1/2, 2/3)	(1,1,1)	0.058

The importance value for each criterion in Table 11.3 has been determined in comparison with the other criteria. As the results of the analyses show, the most significant criterion for VUSR measurement is C1, followed by C2, C3, C4 and C5.

In the context of online USR, the criteria C2 (engagement) has been recognised as the second most important measurement criterion, however, the level of dependency that C2 has on the other criteria has not been considered in the fuzzy AHP analyses. It is important to mention that the quality of engagement is highly dependent on teaching/learning (C1), service (C4) and also research activities (C5). As in this analysis, the fuzzy AHP approach has not considered the interdependencies between criteria, and the researcher believes that the results do not engender enough confident to measure VUSR based on the obtained weights. Hence, for further analyses another technique is required which enables the researcher to consider the level of

dependencies between VUSR measurement criteria as well as their importance with respect to the goal.

11.4. Fuzzy Analytical Network Process (ANP) to Ascertain the Importance of the Measurement Criteria

As in this research the identified criteria for measuring VUSR have some sorts of dependencies, using the fuzzy AHP as the main approach cannot be reasonable. Therefore, in this step to ascertain the significance of each criterion, considering the interrelationships among VUSR criteria, the researcher makes use of the fuzzy ANP. The steps of as proposed by Hussain et al. (2012) are an extension of the process in the previous section , i.e. the fuzzy AHP approach. The extension steps after pairwise comparison of criteria are outlined below.

First step: Identification of the interdependencies between VUSR measurement criteria. In this step, the interdependencies between different criteria are identified according to the literature of VUSR concept as shown in Figure 11.4.

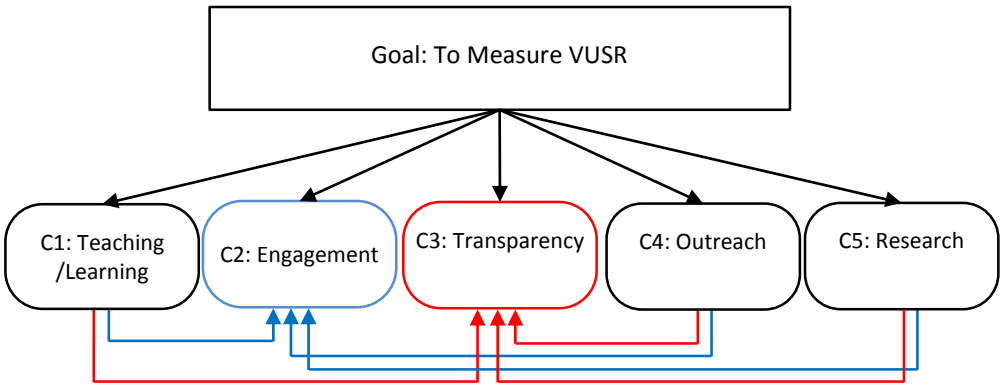


Figure 11-4 The interdependencies between VUSR measurement criteria

In the context of higher education, engagement is a kind of reciprocal interaction between a university and the non-university community which usually happens through the university trinity of mission, i.e., teaching, research and service provision. Therefore, it should be mentioned that the criterion engagement is highly dependent

on the three criteria C1, C4 and C5. Transparency (C3) in this framework is another dependent criterion which is similarly dependent on three main functions of higher education (i.e. C1, C4 and C5). This criterion cannot be measured without considering main the functions of the university as it is dependent on the university's performance in teaching, research and services. Consequently, it can be claimed that without criteria C1, C4 and C5, C4 cannot be obtainable. There are more interrelationships among measurement criteria; however these relationships are not dependencies. Considering these relationships, the level of dependencies between VUSR criteria have been shown in Figure 11.5.

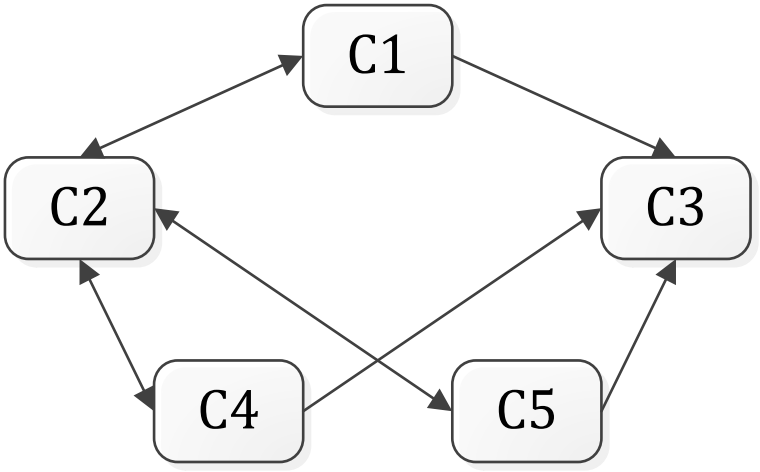


Figure 11-5 Level of dependency between the VUSR measurement criteria

Second step: Constructing the pairwise comparison matrix for the dependent measurement criteria. As in the previous step, the criteria C2 and C3 have been recognised as the dependent criteria and in this step, the pairwise comparison matrices for these criteria have been developed (see Tables 11.4 and 11.5).

Third step: Repeating step five of the fuzzy AHP approach to obtain the relative importance weight of each criterion based of interdependency relationships. In this step, using fuzzy extent analysis approach, the relative importance of the dependent criteria have been analysed (Tables 11.4 and 11.5).

Table 11-4 The interdependence matrix of VUSR measurement criteria with respect to C2

C2	C1	C4	C5	Relative Importance Weights
C1	(1,1,1)	(2, 5/2, 3)	(5/2, 3, 7/2)	1
C4	(1/3, 2/5, 1/2)	(1,1,1)	(1/2, 1, 3/2)	0
C5	(2/7, 1/3, 2/5)	(2/3, 1, 2)	(1,1,1)	0

Table 11-5 The inner dependence matrix of VUSR measurement criteria with respect to C3

C3	C1	C4	C5	Relative Importance Weights
C1	(1,1,1)	(1/2, 1, 3/2)	(1/2, 1, 3/2)	1
C4	(2/3, 1, 2)	(1,1,1)	(1/2, 1, 3/2)	1
C5	(2/3, 1, 2)	(2/3, 1, 2)	(1,1,1)	1

Fourth step: Multiplication of significance values achieved from step five of the fuzzy AHP approach (Table 11.6) with relative importance weights obtained in the previous step to ascertain the final significance value for each VUSR measurement criteria with respect to the goal. The final weight of measurement criteria has been calculated by:

Dependencies between the VUSR measurement criteria X Significance value of criteria with respect to the goal = Final weights of VUSR measurement criteria

Table 11-6 Calculations of dependencies

	C1	C2	C3	C4	C5				
C1	1	1	1	0	0		0.361		1.083
C2	0	1	0	0	0	X	0.323	=	0.323
C3	0	0	1	0	0		0.140		0.140
C4	0	0	1	1	0		0.118		0.236
C5	0	0	1	0	1		0.058		0.116

The final weights of measurement criteria have been normalised to acquire the real significance value for each VUSR measurement criterion. The final results of analyses using two fuzzy AHP and fuzzy ANP approaches have been represented in Table 11.7.

Table 11-7 Significance value after considering interdependencies

AC	Previous Significance Value (Calculated in Fuzzy AHP)	Significance Value after Considering Interdependencies (Calculated in Fuzzy ANP)
C1	0.361	0.571
C2	0.323	0.170
C3	0.140	0.074
C4	0.118	0.124
C5	0.058	0.061

As the results show, the significance values of the measurement criteria have noticeably changed when the interdependencies are considered. Consequently, the ranking of the criteria has changed from C1, C2, C3, C4 and C5 to C1, C2, C4, C3 and C5.

11.5. Fuzzy Logic-based VUSR Metrics

Once the significance value of each criterion has been determined, it is necessary to make a decision regarding the measurement scale of the metrics. As discussed before, the social responsibility of VUs needs to be evaluated in five main dimensions, teaching/learning, engagement, transparency, service provision and research activities. These dimensions are ontology based, and each has a number of indicators. Therefore, to measure VUSR in these dimensions, the researcher should evaluate them through all corresponding indicators. As can be seen, the overview of VUSR metrics is outlined in Table 11.8 which includes 22 indicators for measuring the concept.

Table 11-8 Fuzzy metrics for VUSR

Dimensions		Fuzzy Indicators	Fuzzy Values
Teaching/ Learning	1	The quality of teaching/learning (T/L)	7,6,5,4,3,2,1
	2	The quality of graduates	7,6,5,4,3,2,1
	3	Social responsibility education	7,6,5,4,3,2,1
	4	Ethical performance in teaching/learning	7,6,5,4,3,2,1
	5	The university's expenditure on education improvement	7,6,5,4,3,2,1
Research	6	The quality of research performance	7,6,5,4,3,2,1
	7	Addressing society's needs/issues	7,6,5,4,3,2,1
	8	Ethical performance in research activities	7,6,5,4,3,2,1
	9	The university's expenditure on research improvement	7,6,5,4,3,2,1
Service	10	Quality and quantity of stakeholders' support services	7,6,5,4,3,2,1
	11	Institutional support services	7,6,5,4,3,2,1
	12	Ethical performance in service provision	7,6,5,4,3,2,1
	13	The university's expenditure on service provision and improvement	7,6,5,4,3,2,1
Engagement	14	Engagement through teaching/learning processes	7,6,5,4,3,2,1
	15	Engagement through research	7,6,5,4,3,2,1
	16	Engagement through services	7,6,5,4,3,2,1
	17	Practising and promoting volunteering	7,6,5,4,3,2,1
	18	The university's expenditure on community engagement	7,6,5,4,3,2,1
Transparency	19	The average grade of transparency in teaching/learning	7,6,5,4,3,2,1
	20	The average grade of transparency in research	7,6,5,4,3,2,1
	21	The average grade of transparency in service provision	7,6,5,4,3,2,1
	22	The average grade of transparency in governance	7,6,5,4,3,2,1

In this metrics, the numbers 1 to 7 represent the possible degree of university performance in each indicator. In order to capture the uncertainty involved with these levels, fuzzy values as the researcher calls them, the corresponding fuzzy sets for each level are proposed. For modelling the fuzzy scale for the identified VUSR measurement variables, the following steps have been taken:

- The input variables which should be measured have been identified (e.g. the level of achievement to the sub-criteria).
- The sub-classes that cover the possible levels of each variable have been defined and a linguistic or numeric label has been assigned to each level (e.g. the

linguistic variable of the level of achievement can be defined as seven fuzzy sub-classes: very high, high, above average, average, below average, low and very low, as shown in Figure 11.6).

- The fuzzification method, including the corresponding fuzzy sets, has been determined.
- The defuzzification method, which should be used to generate a crisp output, has been identified.

More details regarding the steps for developing the fuzzy logic-based VUSR metrics will be provided in the next sub-sections. It is important to mention that, because of the qualitative nature of most of the measurement sub-criteria, their corresponding variables are not easily quantifiable using the same linguistic scale. Therefore, those attributes are required to have their specific linguistic or numeric scales which facilitate the interpretation and calculation of the input in the fuzzy scale. In regard to the type of their measurement scales, the VUSR variables can be categorised to different groups.

11.6. Fuzzy Input Variables and the Fuzzy Scales

According to the VUSR measurement framework, there is a large number of variables that need to be included in the VUSR fuzzy logic-based metrics. This section outlines these variables in different groups based on their common measurement scale in the data collection phase. The linguistic/numeric labels have been defined for fuzzy variables in each category. The fuzzy sets for each label have also been determined to represent the membership function for each label. The fuzzy sets here are in the form of triangular fuzzy numbers, which have been defined earlier this chapter. Therefore, in the computation phase, the input (i.e. the user's choice of fuzzy values) will be converted to fuzzy triangular numbers. In another words, in the proposed metrics, for the data collection one can use the linguistic terms just as labels for fuzzy values (very high to very low), while the calculations over them will be done directly over those fuzzy numbers.

The general fuzzy conversion scale is shown in Table 11.9 and its visual representation is depicted in Figure 11.6. As can be seen, in this scale, seven levels of achievement for each variable have been considered – very high, high, above average, average, below average, low and very low. This scale is the ground for all input variables in the VUSR metrics.

Table 11-9 The set of fuzzy values for the VUSR metrics

Fuzzy Values	Corresponding Fuzzy Range
1. Very high (VH)	(0.83, 1, 1)
2. High (H)	(0.67, 0.83, 1)
3. Above average (AA)	(0.5, 0.67, 0.83)
4. Average (A)	(0.33, 0.5, 0.67)
5. Below average (BA)	(0.17, 0.33, 0.5)
6. Low (L)	(0, 0.17, 0.33)
7. Very low (VL)	(0, 0, 0.17)

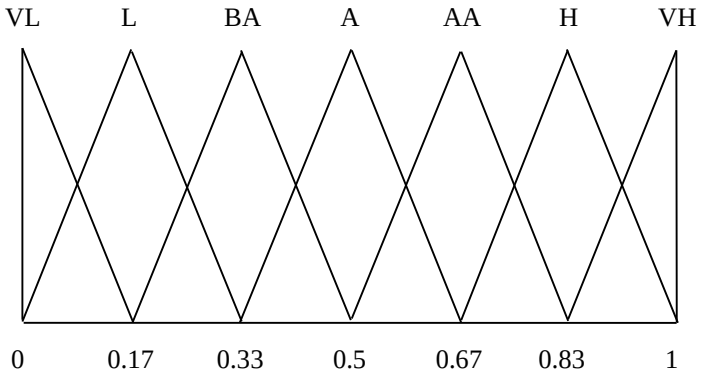


Figure 11-6 The set of seven linguistic terms and their semantic

As outlined in the VUSR measurement framework, a large number of variables have been involved in the process of social responsibility assessment in the VUs. A number of variables are quantitative, while most are qualitative. These variables can be categorised into two broad categories: linguistic fuzzy variables and numerical fuzzy variables.

11.6.1. The Linguistic Variables

The linguistic fuzzy variables have been questioned in the VUSR metrics in different ways. Therefore, the researcher proposes eight scales to deal with different input variables. A large number of variables in this group aim to measure the level to which the university achieved or contributed to the specific attributes. The example variables of this group are as follows: the level of stakeholders' (staff/ student) satisfaction in different aspects, research productivity of graduates, teaching academic integrity in the online learning environment, commitment to intellectual property protection, staff/ student support provision, institutional support, equal opportunity provision for under-served population, staff/students' community engagement, employers' involvement in the process of curriculum development, staff exchanges with other higher education institutions, contribution to sustainable development through services, improving local employability, encouraging staff and students to do volunteering, transparency in students' assessment, teachers' evaluation, university's support for staff/students, and the level of communication with stakeholders. Table 11.10 outlines the proposed scale for linguistic variables aimed at measuring the level of the university achievement or commitment to aforementioned performance attributes.

Table 11-10 The linguistic fuzzy scale one

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The sub-criteria
The level of achievement of … The level of commitment to …	Very high	(0.83, 1, 1)	1, 2, 4, 8 10, 11, 12 14, 16, 17 19, 21, 22
	High	(0.67, 0.83, 1)	
	Above average	(0.5, 0.67, 0.83)	
	Average	(0.33, 0.5, 0.67)	
	Below average	(0.17, 0.33, 0.5)	
	Low	(0, 0.17, 0.33)	
	Very low	(0, 0, 0.17)	

In this table, fuzzy values represent the set of linguistic terms that the user can choose based on the university performance in the specified areas. The third column represents the fuzzy sets which will be employed for the fuzzification of the systems' input. In fact, these sets are the triangular fuzzy numbers which indicate the

membership function of each fuzzy value. The last column in this table represents the VUSR measurement sub-criteria for which the scale will be used.

Another group of linguistic variables aims to measure the level to which the university stakeholders (staff and students) agreed with the phrases showing the university's contribution to social responsibility in different dimensions. The fuzzy values set for this group of variables are outlined in Table 11.11. As the table shows, this scale will be used for assessment of sub-criteria 1, 4, 10, 21 and 22 from the stakeholders' perspectives.

Table 11-11 The linguistic fuzzy scale two

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The sub-criteria
The level of agreement …	Strongly agree	(0.83, 1, 1)	1 4 10 21, 22
	Agree	(0.67, 0.83, 1)	
	Slightly agree	(0.5, 0.67, 0.83)	
	Neither	(0.33, 0.5, 0.67)	
	Slightly disagree	(0.17, 0.33, 0.5)	
	Disagree	(0, 0.17, 0.33)	
	Strongly disagree	(0, 0, 0.17)	

Some of the other variables in the metrics are unique in regard to their scale and the quantification. As can be seen in the aforementioned scales, each fuzzy value has a corresponding fuzzy set which is in a descending order from high to low. However, there are two variables in the metrics for measuring the quality of teaching/learning and the university's ethical performance in teaching/learning activities which have no order. The first variable in this group is measuring the quality of online degree entrance requirements in different levels (undergraduate and postgraduates studies), and the second measures the university's commitment to online learners' authentication in the assessments. For quantification of each of these two variables, seven different options have been proposed in the VUSR metrics that users can choose from based on the university's policies and practices. One of these options is labelled 'None' which indicates the university has no commitment in the field, however another six options indicated different possible contributions to the variable. As it is impossible to prioritise these options like the previous scales, the assumption is that all the six

options have the same level of value. As users can choose more than one option, the fuzzification of input is proposed to be based on the number of options that users choose. If the user chooses the 'None' option, the system translates it to 'Very low' and the fuzzy sets will be (0, 0, 0.17) otherwise, where *n* is the number of options that user will choose, *FV* is the fuzzy value of the input and *FS* is the fuzzy sets for the input, the fuzzification of the input will be based on the following:

if	$n = 1$	*FV* = Low	*FS* = (0, 0.17, 0.33)
if	$n = 2$	*FV* = Below average	*FS* = (0.17, 0.33, 0.5)
if	$n = 3$	*FV* = Average	*FS* = (0.33, 0.5, 0.67)
if	$n = 4$	*FV* = Above average	*FS* = (0.5, 0.67, 0.83)
if	$n = 5$	*FV* = High	*FS* = (0.67, 0.83, 1)
if	$n = 6$	*FV* = Very high	*FS* = (0.83, 1, 1)

The fuzzy scale for this group of linguistic variables is shown in Table 11.12.

Table 11-12 The linguistic fuzzy scale three

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The sub-criteria
• The online degree entrance requirements in different levels • The identification techniques for authentication of online learners	6 options from the list	(0.83, 1, 1)	1 4
	5 options from the list	(0.67, 0.83, 1)	
	4 options from the list	(0.5, 0.67, 0.83)	
	3 options from the list	(0.33, 0.5, 0.67)	
	2 options from the list	(0.17, 0.33, 0.5)	
	1 option from the list	(0, 0.17, 0.33)	
	None	(0, 0, 0.17)	

Another group of linguistic variables are those aiming to measure the frequencies in a timeframe. Four different fuzzy scales have been proposed for this group of linguistic variables. The most frequent scale in this category is proposed for those variables where their highest possible occurrence is assumed to be every semester. The frequency of staff training programs, online units' content reviews, learning materials' updates, assessment tools' reviews, teaching quality assessments, technology quality assessments, staff/student feedback evaluations, on-campus events (e.g. seminars, etc.) are some of these variables. For the MC5 (transparency) the timeframe in which the university publishes the quality assessment results, internal research funding

distribution, external grants, quality of research performance, level of staff/students' satisfaction, the governing structure updates, the management structure updates at different levels, and the board members updates have been questioned. For quantification of all these variables, the highest possible value is considered 'Every semester' and the least possible value considered to be 'Never'. The following table outlines the fuzzy scale for this group of variables. This scale will be used for the measurement criteria 1, 14, 19, 20, 21 and 22 in the VUSR metrics (see Table 11.13).

Table 11-13 The linguistic fuzzy scale four

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The sub-criteria
The frequency of • updating • reviewing • publishing • organising • evaluating • etc.	Every semester	(0.83, 1, 1)	1 14 19, 20, 21, 22
	Every year	(0.67, 0.83, 1)	
	Every two years	(0.5, 0.67, 0.83)	
	Every three years	(0.33, 0.5, 0.67)	
	Every four years	(0.17, 0.33, 0.5)	
	Every five years/more	(0, 0.17, 0.33)	
	Never	(0, 0, 0.17)	

The next scale of this category has been proposed for those variables where their highest possible value is assumed to be 'Every year'. For instance, the timeframe for design and delivery standards, online material's copyright policies and regulations, intellectual property protection policies, staff contact information on the website would be reviewed/updated has been considered in this category. The university's contribution to publishing the national university ranking results and the providing financial support for staff/students will be measured through this scale. Table 11.14 presents the linguistic sets and their corresponding fuzzy sets of this scale. As shown in the table, this scale will be used for assessment of the sub-criteria 1, 4, 8, 19, 20 and 21.

Table 11-14 The linguistic fuzzy scale five

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The sub-criteria
The frequency of • updating • reviewing • publishing	Every year	(0.83, 1, 1)	1, 4 8 19, 20, 21
	Every two years	(0.67, 0.83, 1)	
	Every three years	(0.5, 0.67, 0.83)	
	Every four years	(0.33, 0.5, 0.67)	
	Every five years	(0.17, 0.33, 0.5)	
	Every six years/more	(0, 0.17, 0.33)	
	Never	(0, 0, 0.17)	

Table 11.15 outlines another timeframe scale proposed specifically for one variable in the VUSR metrics. The variable aims to measure the frequency of the university's commitment to review the online courses' curriculum.

Table 11-15 The linguistic fuzzy scale six

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The sub-criteria
The frequency of curriculum review for each online course	Every two years	(0.83, 1, 1)	1
	Every three years	(0.67, 0.83, 1)	
	Every four years	(0.5, 0.67, 0.83)	
	Every five years	(0.33, 0.5, 0.67)	
	Every six years	(0.17, 0.33, 0.5)	
	Every seven years/more	(0, 0.17, 0.33)	
	Never	(0, 0, 0.17)	

As above table shows, the highest possible fuzzy value for curriculum review is assumed to be 'Every two years' and the least possible value expected to be 'Never'. In the proposed VUSR metrics, this scale will be used just once for measuring the first VUSR sub-criterion, i.e. quality of teaching/learning.

Another fuzzy scale that will be used just for one variable and is measuring the variable based on a timeframe is outlined in Table 11.16. This scale aims to measure the frequency of students' learning assessments in each unit, which is the variable for the quality of teaching/learning in the VUSR measurement framework. The highest possible fuzzy value for this variable is assumed to be 'Weekly' and the least possible value is the case where the unit has 'no assessment'. Another five values are between

them and are placed in the metrics in descending order. The corresponding fuzzy sets for each value are shown in the table below.

Table 11-16 The linguistic fuzzy scale seven

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The sub-criteria
The frequency of learning assessment for each online unit	Weekly	(0.83, 1, 1)	1
	Fortnightly	(0.67, 0.83, 1)	
	Monthly	(0.5, 0.67, 0.83)	
	Three times in each unit	(0.33, 0.5, 0.67)	
	Two times in each unit	(0.17, 0.33, 0.5)	
	Once in each unit	(0, 0.17, 0.33)	
	There is no assessment	(0, 0, 0.17)	

In the proposed VUSR metrics, there are three items questioning the existence of evidence of the university's commitment to social responsibility. The first instance of the variables belongs to sub-criterion 1 (quality of teaching/learning). In this case, the university will be questioned whether it has established any centralised system for developing and maintaining the virtual course infrastructure or developed any documented plan to improve the technology infrastructure.

Another instance belongs to the sub-criterion 16 (community engagement through services) where the metrics asks about the existence of any sustainable development group with members across the university. The only possible options for this group of variables is 'Yes' or 'No', consequently, in this case having seven different fuzzy sets as other scales sounds impossible. Therefore, the researcher proposes to make use of the highest and the least fuzzy sets from the general fuzzy conversion scale (Table 11.9) to fuzzify the input of the metrics. Table 11.17 outlines the suggested scale for this group of variables.

Table 11-17 The linguistic fuzzy scale eight

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The sub-criteria
Is there any …	Yes	(0.83, 1, 1)	1 16
	No	(0, 0, 0.17)	

11.6.2. The Numerical Variables

In the second category, called numerical, are those variables proposed to be measured using a range of numbers. All the VUSR variables that question the numbers, percentages, ratios and grades are in this category. A total of five fuzzy scales have been proposed in this category, which will be outlined in the following tables. The first group of variables are those that will be measure based on the percentages (see Table 11.18).

Table 11-18 The numerical fuzzy scale one

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The Sub-criteria
The percentage of … The completion rate …	100% _ 83.01%	(0.83, 1, 1)	1, 2, 3, 4, 5 6, 7, 9 10, 12, 13 14, 15, 16, 17, 18 22
	83% _ 67.01%	(0.67, 0.83, 1)	
	67% _ 50.01%	(0.5, 0.67, 0.83)	
	50% _ 33.01%	(0.33, 0.5, 0.67)	
	33% _ 17.01%	(0.17, 0.33, 0.5)	
	17% _ 0.01%	(0, 0.17, 0.33)	
	0	(0, 0, 0.17)	

A large number of variables are in this group: the percentage of online units linked to real-world practices, courses teaching entrepreneurship skills, students who engage with the courses, work-integrated learning modules, staff who attended -skill development programs, graduates who have been employed, learning modules aimed at social responsibility education, students from disadvantaged groups, learning modules designed to meet visually disadvantaged learners, the university's annual funding allocated to vocational education, just to name a few. The completion rate of graduates is also proposed to be measured based on this scale. The highest possible value for this group of variables is proposed to be a number between 100% to 83.01% and the least possible value is proposed to be 0. These values are in a seven-point scale and their corresponding fuzzy sets are the same as defined earlier in this chapter. As shown in Table 11.18, this scale is proposed to be used for most of the VUSR measurement sub-criteria, including 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18 and 22. In fact, this scale is the most common scale in the VUSR metrics.

The second numerical scale is developed to measure VUSR variables based on the ratios. Variables such as the instructor–students ratio, the online units that have been reviewed, staff and students' participation in the quality measurement process and stakeholder satisfaction surveys, services that the university have been provided for disadvantaged groups and staff and students' complaints are proposed to be quantified based on ratios. All these variables belong to the VUSR sub-criteria 1 and 12 which focus on measuring QOTL as well as quantity and quality of the university support services for stakeholders. This scale has seven levels between 1 to 0. Table 11.19 shows the corresponding fuzzy sets for each value on this scale.

Table 11-19 The numerical fuzzy scale two

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The Sub-criteria
The ratios of …	1 _ 0.84	(0.83, 1, 1)	1 12
	0.83 _ 0.68	(0.67, 0.83, 1)	
	0.67 _ 0.51	(0.5, 0.67, 0.83)	
	0.50 _ 0.34	(0.33, 0.5, 0.67)	
	0.33 _ 0.18	(0.17, 0.33, 0.5)	
	0.17 _ 0.01	(0, 0.17, 0.33)	
	0	(0, 0, 0.17)	

The next numerical fuzzy scale aims to measure the sub-criterion 2 (i.e. quality of graduates) in regard to the average grade of graduates' results in different levels (undergraduate and postgraduate). The grading scale is assumed to be the scale of 0 to 100, which is divided into seven equal levels, the highest value can be in the range of 100 to 83.01 and the least value is assumed to be 0 (see Table 11.20). The third proposed numerical scale is also applicable for measuring sub-criterion 6 (the quality of research performance) in regard to the average number of citations for each research staff member and the applied projects that have been completed by the university's staff during the last academic calendar. In the proposed scale, the assumption is that the highest expected average number of citations for each research staff should be 100, and the same assumption has been considered for the number of applied projects. Therefore, the distance between 0 and 100 has been divided into seven levels

representing different fuzzy values on the scale. In this variable, if the average highest value is more than 100, it falls into the same level.

Table 11-20 The numerical fuzzy scale three

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The Sub-criteria
The average grade of graduates' results The average number of citations for each research staff member The number of completed applied research projects during last academic calendar	100 _ 83.01	(0.83, 1, 1)	2 6
	83 _ 67.01	(0.67, 0.83, 1)	
	67 _ 50.01	(0.5, 0.67, 0.83)	
	50 _ 33.01	(0.33, 0.5, 0.67)	
	33 _ 17.01	(0.17, 0.33, 0.5)	
	17 _ 0.01	(0, 0.17, 0.33)	
	0	(0, 0, 0.17)	

Another numerical scale is proposed for quantification of one of the variables of the sub-criterion 1 (i.e. QOTL). The variable is aimed at measuring the number of hours that the university allocated to moderation sessions for online instructors. The highest possible value in this scale is assumed to be 05:30 to 06:00 (or more) hours, and the least possible value is assumed to be 0:00. Table 11.21 outlines the values between these two options which users can choose based on the university's policies. For this scale, similar to the previous ones, the corresponding fuzzy sets for each value have been presented (see Table 11.21).

Table 11-21 The numerical fuzzy scale four

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The Sub-criteria
The number of hours allocated to moderation sessions for online instructors	05:30 _ 06:00 (or more)	(0.83, 1, 1)	1
	04:30 _ 05:00	(0.67, 0.83, 1)	
	03:30 _ 04:00	(0.5, 0.67, 0.83)	
	02:30 _ 03:00	(0.33, 0.5, 0.67)	
	01:30 _ 02:00	(0.17, 0.33, 0.5)	
	00:30 _ 01:00	(0, 0.17, 0.33)	
	00:00	(0, 0, 0.17)	

In the VUSR metrics, it is proposed that some of variables are measured based on the number of occurrences. For instance, meetings organised by the assessment quality panel in each semester; university events aimed at social responsibility education; collaborative meetings for staff/students in each unit; volunteering activities organised by the university annually; and the annual reports that the university published during last six years are proposed to be measured based on their occurrence in the specified timeframe. The proposed scale for this group of numerical variables is outlined in Table 11.22. As can be seen, the highest possible value in this scale is assumed as 6 (or more), and the least possible value is assumed as 0. This scale has seven levels which are proposed to be used for quantification of VUSR sub-criteria 1, 3, 14, 17 and 22 through the aforementioned variables.

Table 11-22 The numerical fuzzy scale five

What the Variable Measures	Fuzzy Values	Fuzzy Sets	The Sub-criteria
The average number of ...	6 (or more)	(0.83, 1, 1)	1, 3 14, 15, 17 22
	5	(0.67, 0.83, 1)	
	4	(0.5, 0.67, 0.83)	
	3	(0.33, 0.5, 0.67)	
	2	(0.17, 0.33, 0.5)	
	1	(0, 0.17, 0.33)	
	0	(0, 0, 0.17)	

In this section a total number of 13 different scale have been defined which all will be used in the VUSR metrics. The fuzzy outputs that attained from these scales will be aggregated and provide a total score of the university VUSR. However, as there cannot be any uncertainty for the final results, the fuzzy number must be converted back to the crisp values.

11.7. The Defuzzification Method

Considering the nature of human actions and decisions regarding the output of each evaluation based on the crisp or binary values, it is necessary to ‘defuzzify’ the output

the system generates using fuzzy sets. Therefore, it is necessary to transform the fuzzy sets that the VUSR metrics provides as the final score into a crisp value. Mathematically, this process which is called 'defuzzification' is the process of 'rounding off' the fuzzy values (Ross, 2010). While fuzzy sets can be defined as a collection of membership functions or values on a vector, the defuzzification process decreases this vector to a single quantity which is assumed to be the most representative value for the set.

In the literature, there are many different ways to defuzzify fuzzy sets and generate crisp values. A number of techniques are applicable in a case where the output is in the form of symmetrical membership functions (e.g. weighted average method) or where it contains more than one set of fuzzy values (e.g. mean-max membership method). According to the output format in this metrics, which is a set of triangular fuzzy numbers with asymmetrical membership functions, the most appropriate defuzzification is assumed to be the centroid method. In the literature, this technique has been the most popular and physically appealing defuzzification technique (Ibrahim, 2004; Ross, 2010). This method, which is also known as the centre of gravity or centre of area, has been represented in the algebraic expression as:

$$x^* = \frac{\int \mu_{F\,(x)} \,.\, x dx}{\int \mu_{F\,(x)} dx}$$

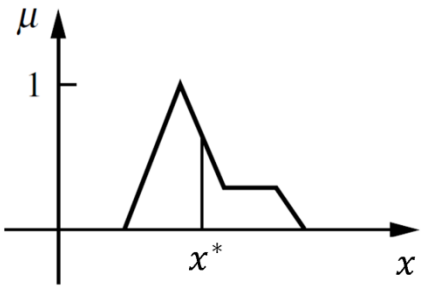


Figure 11-7 The centroid defuzzification method

Where x^* is the defuzzified output, the symbol $\int$ indicates the algebraic integration. The visual representation of the defuzzification can be seen in Figure 11.7.

11.8. Conclusion

This chapter represented a fuzzy AHP approach to prioritise the VUSR measurement criteria according to the researcher's findings from the literature analyses. As the identified measurement criteria have some dependencies, this chapter outlined another fuzzy ANP approach to ascertain the significant value of each VUSR measurement criterion. Section 11.5 outlined the VUSR measurement metrics. The metrics have been organised based on the VUSR measurement framework, which is defined in Chapters 8 and 9. In section 11.6 the fuzzy input variables and the linguistic and numerical scales of the VUSR metrics were presented. In the last section, the researcher proposed the fuzzification method for the developed metrics. The next chapter of this thesis will demonstrate how the metrics defined here will be implemented.

Chapter 12_ USR/VUSR Ontology Validation and Verification

12.1. Introduction

In order to validate this ontology representation of social responsibility and USR, as well as VUSR, as the foundation for the body of knowledge in the area of CSR, this research uses the SAOD method to prove the ontology creation, concept formation and relationship development, from over 800 publications, as shown in the literature review of Chapter 2. This includes text mining approaches, including NVivo Analyses, word frequency counts, word cluster maps, word clouds, theme visibility and statistical methods. These will be shown in detail in this chapter. These word analytics form the foundation for developing the world's first ontology of social responsibility and USR, as well as VUSR.

This chapter organized in seven sections to provide details on the verification of the engineered ontology. The next following section will define the approach of the research for ontology development. The first step of approach which is the identification of body of knowledge will be described in section 12.3. The process of analysing the body of knowledge to find main concepts and their relationships as the second and third steps of this approach will be presented in sections 12.4 and 12.5. Section 12.6 will provide details on ontology refinement as the forth step of thesis approach to ontology development. At the end the chapter will be concluded.

12.2. Using the Semi-automated Ontology Design (SAOD) Method

Before going into details of the approach, it is important to mention that, as the concept of social responsibility in the context of VUSR is a new field of research and

development, this research rests on the existing body of knowledge of the concept of social responsibility in a university context in general (i.e. USR). Once the first draft of the ontology has been developed, it will be modified according to the specifications of the online education context. Following the definitions provided by Hadzic et al. (2009), the ‘concept’ here refers to a unit of thought and the ‘term’ is a lexical representation of a concept.

As mentioned, the researcher proposes a SAOD approach. This approach for ontology engineering takes advantage of text mining techniques using content analysis software and comprises four main steps. The first aims to identify the relevant body of knowledge of the concept by searching the scientific databases. The second step involves the researcher analysing the existing body of knowledge to identify the main factors of the concept domain. The third step involves the researcher with another content analysis to extract the relationships between the main factors of the USR concept. In order to extract the visualisation of the USR ontology, the last step proposed is the refinement processes for the output of the previous steps. The following sections provide more detail about each step.

12.3. Identification of the Relevant Body of Knowledge

As the concept of USR is a relatively new one, there is no globally accepted view of its key concepts and the nature and strength of relationships between these concepts. Therefore, in the first step, all existing contributions defining the social responsibility of universities were compiled. In order to compile the body of knowledge, key terms such as ‘university social responsibility’, ‘university community engagement’, ‘university public engagement’, ‘scholarship of engagement’ and ‘corporate social responsibility of university’ were searched in Google Scholar. More search queries were run through databases such as Scopus, Science Direct, Web of Science, Emerald, and so on (Figure 12.1).

Figure 12-1 The academic databases searched for the first step

The results in this stage were 98 scholarly published documents (between 1996 and 2010), including book chapters, journal papers, conference proceedings and research reports, which all have been reviewed to extract the definitions proposed for the main concept of this research. The contributions include definitions for university social responsibility, scholarship of engagement, and university community (public or civic) engagement. After reviewing these documents, 18 contributions were extracted. However, the use of definitions only for the purpose of analysis is an inefficient means of extracting meaningful information, because not all the key concepts in contributions are reflected in the definitions. Therefore, to build a reasonable corpus of information enabling meaningful analysis, pieces of relevant text that describe USR have been compiled. The output of this stage was a document of 20,526 words around the main notion of this research, which made the corpus of data for ontology generation.

12.4. Analysing the Body of Knowledge to Identify the Main Notions

After collecting the relevant body of knowledge, including definitions of the given concept for which the ontology needs to be developed (USR), NVivo software was employed to extract the main concepts and most referenced notions in the literature. In order to establish confidence in the identified concepts, Leximancer software was used for a second analysis.

12.4.1. NVivo Analyses Output

In the first step, QSR NVivo 9, which is qualitative data analysis software (QSR International, 2010), was used to analyse the body of knowledge. Before analysing the whole corpus of data, the concept definitions, c of 1214 words, were imported into the project. Table 12.1 presents the first word frequency query results in NVivo, considering just USR definitions.

Table 12-1 Word query results considering USR definitions

Word	Count	Weighted (%)	Similar Words
engagement	15	4.85	communities, community
community	13	4.21	engaged, engagement, engagement'
responsibility	6	1.94	responsibilities, responsibility, responsible
education	5	1.62	educated, education, educational
Public	5	1.62	public, 'public, 'public'
interaction	4	1.29	interacting, interaction, interactive
research	4	1.29	research, researchers
Social	4	1.29	social, socially
teaching	4	1.29	Teaching
Civic	3	0.97	Civic
faculty	3	0.97	Faculty
knowledge	3	0.97	Knowledge
Local	3	0.97	local, locality
quality	3	0.97	Quality
students	3	0.97	Students
activities	2	0.65	activities, activity
citizens	2	0.65	citizens, citizens’
economic	2	0.65	economic, economical
employees	2	0.65	Employees
environmental	2	0.65	Environmental
ethical	2	0.65	Ethical
groups	2	0.65	Groups
learning	2	0.65	Learning
management	2	0.65	Management
organizations	2	0.65	Organizations
resources	2	0.65	Resources
society	2	0.65	Society
specialists	2	0.65	Specialists
Staff	2	0.65	staff, staffs
sustainable	2	0.65	Sustainable

It is important to mention in all the analyses, the term ‘university’ was inserted in the word stop list to prevent it from affecting the weighted percentage of the sub-concept of USR. The exploratory technique in NVivo assisted the researcher in visualising the word frequency patterns in the USR definitions by grouping early nodes that share similar words. Figure 12.2 illustrates the cluster analysis diagram, which makes it easy to see similarities and differences patterns in the data. Each cluster shows a bunch of terms by which the USR concepts have been defined in the literature and contain similar patterns of frequencies. For example, as can be seen, the notions education, responsible, community and engagement have been clustered in the same bunch here.

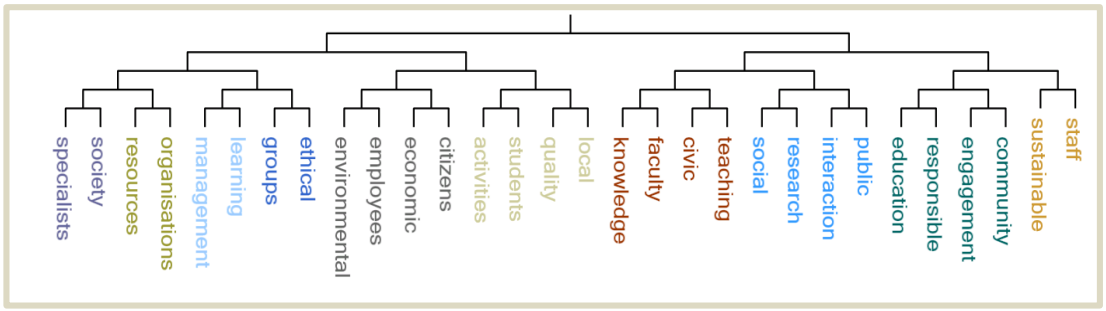


Figure 12-2 Cluster analysis diagram extracted from USR definitions

According to the initial analysis of USR definitions, the most frequent notions include engagement, community, responsibility, education and public. As expected, analysing only definitions, which do not include entire discussed notions regarding the concept, is not meaningful. Therefore, in the next step, the whole corpus source of 20,526 words was considered, to extract the common vocabulary within the USR domain.

The word frequency query was run to ascertain the main notions used to define social responsibility in the higher education domain. In order to have a more precise output, unwanted words such as ‘approach’, ‘important’, ‘example’, ‘sense’, and so forth, were eliminated. As the word ‘university’ is the main subject in this context, it also was eliminated to specify the weighted percentage of the main notions. The output of NVivo word frequency query considering the corpus source is outlined in Table12.2 and the graphical representation of these analyses is illustrated in Figure 12.3 (cluster analysis diagram).

Table 12-2 Word query results considering the whole corpus source

Word	Count	Weighted (%)	Similar Words
engagement	384	2.51	engagement, engagements
community	346	2.26	communities, community
education	206	1.35	educate, educating, education, educational
scholarship	202	1.32	Scholarship
Public	190	1.24	public, publicly, publics
Social	188	1.23	social, socially
learning	177	1.16	learn, learning
research	174	1.14	research, researched, discovery
students	165	1.08	student, students
responsible	157	1.03	responsibilities, responsibility, responsible
knowledge	121	0.79	Knowledge
society	119	0.78	societies, society
service	118	0.77	service, services
institutions	97	0.63	institute, institutes, institution, institutional, institutions
faculty	90	0.59	faculties, faculty
teaching	84	0.55	teach, teaching
scholars	79	0.52	scholar, scholarly, scholars
activity	77	0.50	active, actively, activism, activities, activity
Issues	77	0.50	issue, issued, issues, issuing
academics	70	0.46	academe, academic, academically, academics
organization	66	0.43	organism, organization, organizations
environment	61	0.40	environment, environments, environmental
sustainable	46	0.30	sustainability, sustainable
Civic	43	0.28	Civic
Needs	42	0.27	Needs
economic	42	0.27	economic, economical
campus	40	0.26	campus, campuses
culture	39	0.26	cultural, culture, cultures
partnerships	39	0.26	partnership, partnerships
values	38	0.25	value, values
individuals	36	0.24	individual, individualism, individually, individuals
outreach	35	0.23	Outreach
resources	34	0.22	resource, resources
governments	32	0.21	govern, governance, government, governments
Ethics	32	0.21	ethic, ethical, ethically, ethics, moral, morally
Staff	29	0.19	staff, staffs
discovery	28	0.18	discoveries, discovery
people	27	0.18	people, peoples
business	27	0.18	business, businesses
citizens	25	0.16	citizen, citizens
colleges	25	0.16	college, colleges
stakeholders	24	0.16	stakeholder, stakeholders
schools	23	0.15	school, schooling, schools
partners	22	0.14	partner, partners
technology	21	0.14	technological, technologies, technology
health	20	0.13	Health
products	20	0.13	product, products
results	19	0.12	result, resulting, results
curriculum	18	0.12	curriculum, curriculums

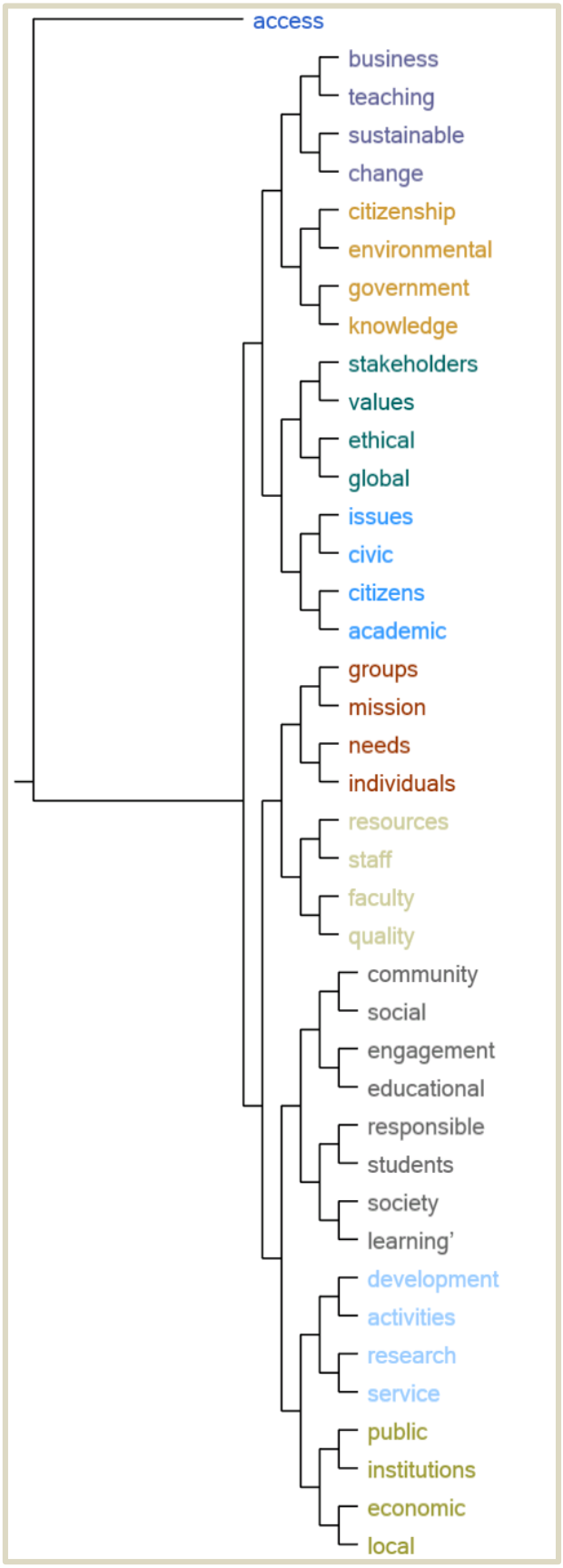


Figure 12-3 Cluster analysis diagram extracted from the corpus source

The diagram shown in Figure 12.3 depicts the words that contain a higher degree of similarity based on their occurrence and frequency in the same cluster. For instance, the words ‘community’, ‘social’, ‘engagement’ and ‘educational’ have been clustered in the same category, which means the frequency and occurrence patterns of these words are similar. The number of clusters has been set at 18 to see how different notions will be categorised. The result appears in a 3D cluster map where similar words are clustered together and different words are further apart (Figure 12.4). In this representation, the words ‘community’, ‘engagement’, ‘education’ and ‘public’ are clustered in the same category, which is the most highlighted cluster (blue globs). Similarly, the words ‘research’, ‘learning’, ‘knowledge’ and ‘students’ are grouped in the same cluster, which appears to be the second most important cluster in the map (red globs). The colours in NVivo outputs have been used to differentiate clusters and contain no specific meanings or preferences.

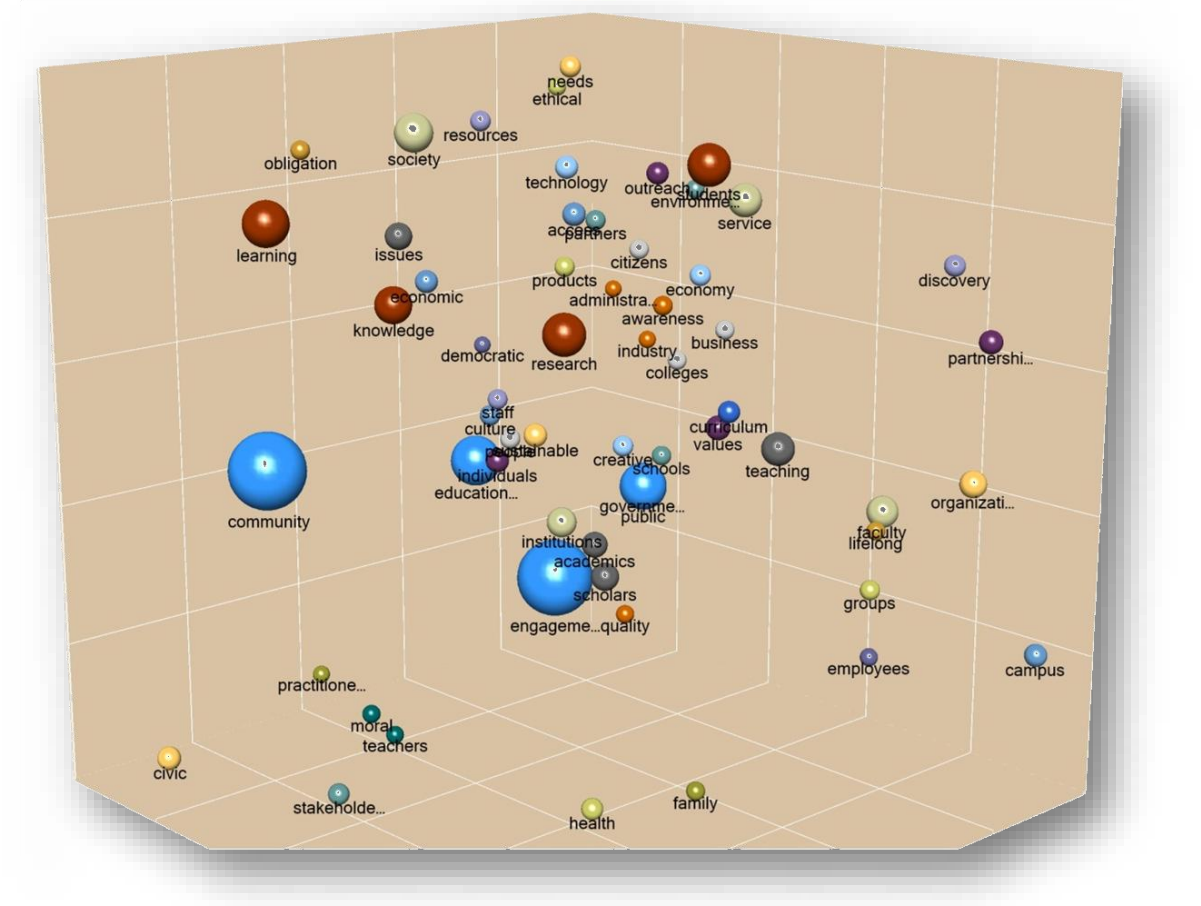


Figure 12-4 The cluster map extracted from the corpus source

12.4.2. Leximancer Analyses Output

In this step, the same documents have been analysed using Leximancer 3.5 (Leximancer 3 Desktop, 2010). This software is a text-mining tool that enables researchers to examine and identify the key themes and concepts in the text-based documents. Leximancer extracts meaningful representations from the texts based on the word co-occurrences and takes advantage of machine-learning techniques to demonstrate semantic patterns from the text. The software has been used in different domains to analyse patient records, interview transcripts, e-mails and an existing body of knowledge.

Similar to the previous step, the analyses have been run in two levels; firstly, considering only the concept's definitions, and then considering the whole corpus source. The initial analyses using Leximancer (see Table 12.3) revealed similar figures to the NVivo output (Table 12.1) about the patterns of frequencies of words.

Table 12-3 Ranked concepts, frequencies and relevance considering USR definitions

Word-Like	Count	Relevance
engagement	16	100%
community	12	75%
responsibility	9	56%
education	7	44%
partnership	6	38%
scholarship	6	38%
teaching	6	38%
resources	5	31%
address	5	31%
civic	5	31%
knowledge	5	31%
learning	5	31%
social	5	31%
faculty	5	31%
public	4	25%
society	3	19%
sectors	2	12%
values	2	12%
academic	2	12%
collaboration	2	12%
outreach	2	12%

As Table 12.3 shows, the software analysis of the concept's definitions in the second content analysis figured out different statistics, however the word rankings are

almost the same. It is worthwhile mentioning that the different statistics in word counts here are a result of the way the software considers similar terms and counts them as the same word. The relevance column in the table shows the percentage frequency of the text segments that are coded with the concept. Leximancer calculates the relevance by dividing each concept's count into 100%, which is the top word's count. Another output of analysis that shows the most important themes in the text is thematic summary (see Figure 12.5).

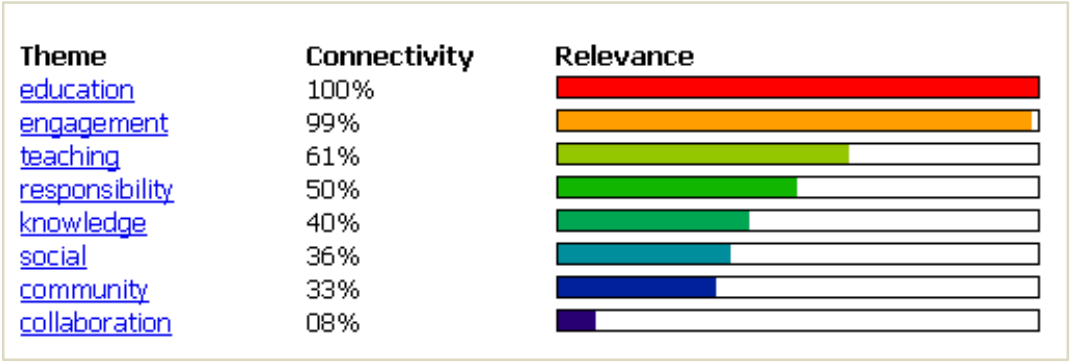


Figure 12-5 The thematic summary of the the concept considering USR definitions

The thematic summary of analysis reveals that, according to the existing definitions, the most important themes of the USR concept are education, engagement, teaching (which can be considered with education in the same category), responsibility, knowledge, social, community and collaboration. The 'theme' in this context refers to a group of concepts that contains some commonality or connections in the analysed body of text. The histogram bars in above figure are colour-coded to indicate the prevalence of each theme. The hot colours (red and orange) demonstrate the most prevalent themes (i.e. education and engagement). Figure 12.6 represents the concept cloud extracted from the USR definitions.

Figure 12-6 The concept cloud considering USR definitions

In the second level, all analyses have been repeated with the whole data. The same text source, including USR definitions and their related discussions containing 20,526 words extracted from the literature, was imported into Leximancer. As expected, the results were not similar to the initial analyses. Not only the word frequencies, but also the highlighted themes and the concept rankings changed in these analyses. The thematic summary (Figure 12.7) shows university and community as the most relevant themes to the context. Similar to analyses with NVivo, here the word 'university' as the main subject has been eliminated to specify the connectivity and relevance of other notions. As the thematic summary shows, other themes need to be eliminated for more precise results. Therefore, terms such as 'activities', 'strategies', 'definitions', 'example', 'place', and many others have been eliminated for further analyses.

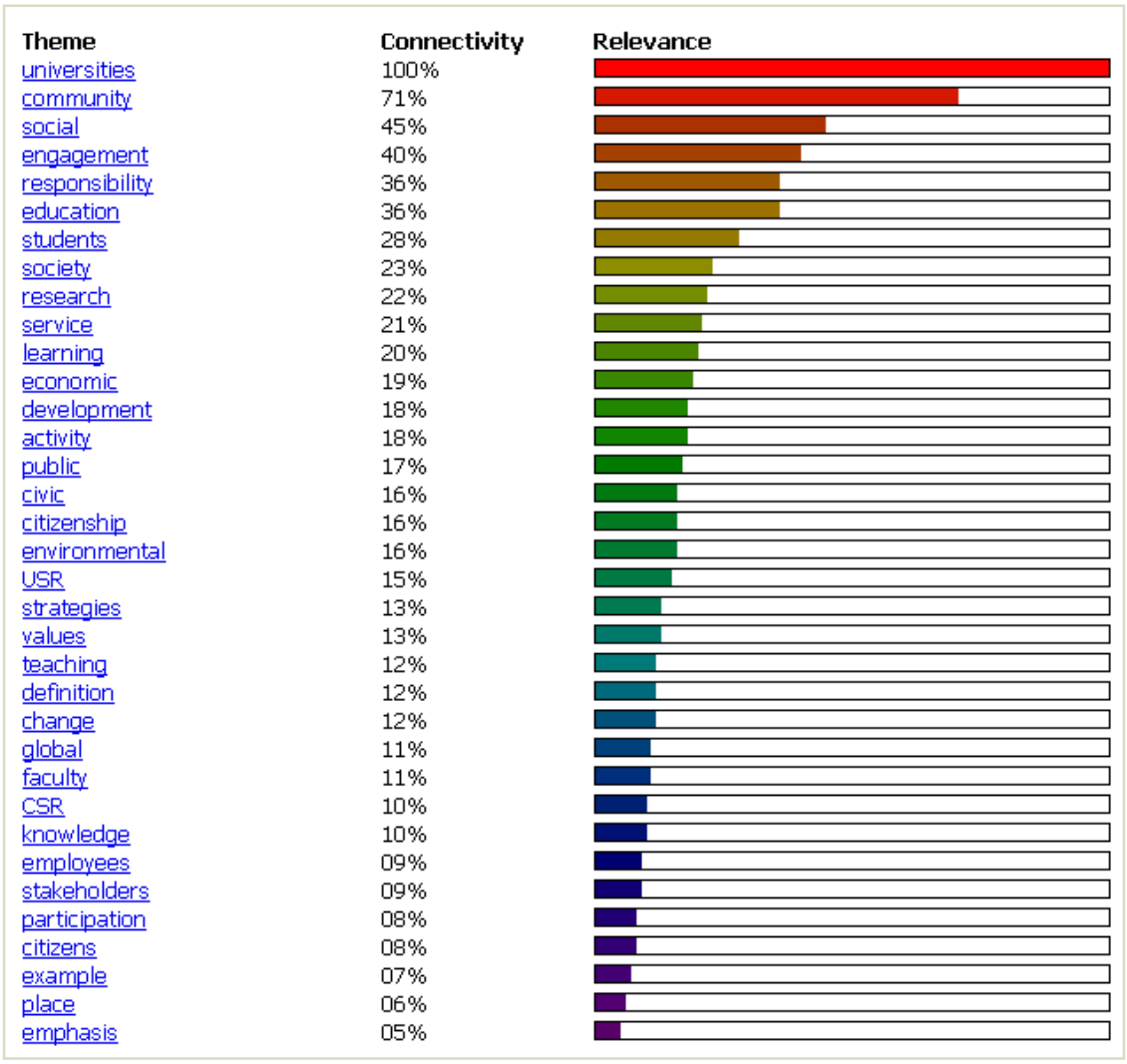


Figure 12-7 The initial thematic summary considering the whole corpus

Further analyses reveal the highest ranking in the corpus of data belongs to the terms ‘engagement’, ‘community’, ‘research’, ‘education’ and ‘scholarship’ respectively (see table 12.4).

Table 12-4 Ranked concepts, frequencies and relevance considering the whole corpus source

Name-Like	Count	Relevance
USR	24	08%

Word-Like	Count	Relevance
engagement	295	100%
community	205	69%
research	172	58%
education	166	56%
scholarship	141	48%
social	135	46%
public	135	46%
students	128	43%
responsibility	123	42%
learning	121	41%
knowledge	92	31%
society	91	31%
service	79	27%
teaching	77	26%
faculty	68	23%
development	68	23%
institutions	62	21%
academic	57	19%
issues	51	17%
integration	44	15%
needs	38	13%
civic	36	12%
values	33	11%
economic	32	11%
local	31	11%
individual	30	10%
change	30	10%
application	29	10%
access	27	09%
outreach	27	09%
environmental	26	09%
campuses	25	08%
people	24	08%
staff	23	08%
global	22	07%
partnerships	21	07%
citizenship	20	07%
schools	19	06%
technology	18	06%

According to the concept ranking extracted from Leximancer analyses, the first six most frequent terms in the corpus source are, respectively, engagement, community, research, education, scholarship and social. This result supports the output of word frequency query from NVivo, where the most frequent words were identified as engagement, community, education, scholarship, public and social. However, there

are some differences on the words rankings as well as word counts. The reason, as mentioned before, is the approach by which the software extracts information. For example, as can be seen, the term 'research' in the Leximancer output is indicated as the third notion, while in the NVivo output, it does not appear in the top five. The statistics for each word in NVivo are higher than demonstrated by Leximancer, because the earlier software enables the researcher to define similar words in the context. Regardless of minor differences, as mentioned before, the results obtained by the NVivo software were supported by the Leximancer output. Although the frequencies shown by Leximancer are not equivalent to the NVivo results, the rankings are almost similar.

While Leximancer analyses the corpus of the text, it clusters the concepts into higher-level 'themes' (see Figure 12.8). As mentioned before, themes are the representatives of groups of concepts that appear together in the same pieces of text and have commonality or connections in the analysed body of text. The concept cloud of this stage of the analyses is illustrated in Figure 12.9. Both the thematic summary and the concept cloud are heat-mapped where hot colours (red, orange and pink) denote the most significant concepts, and cool colours (green and blue) represent the less significant ones. The font size of each concept's label in the concept cloud shows the frequency of the concept in the corpus of text.

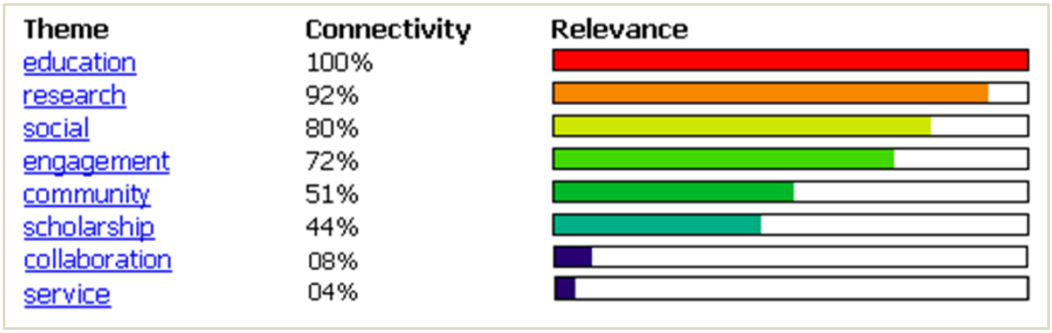


Figure 12-8 The Thematic Summary of the concept considering the whole corpus of data

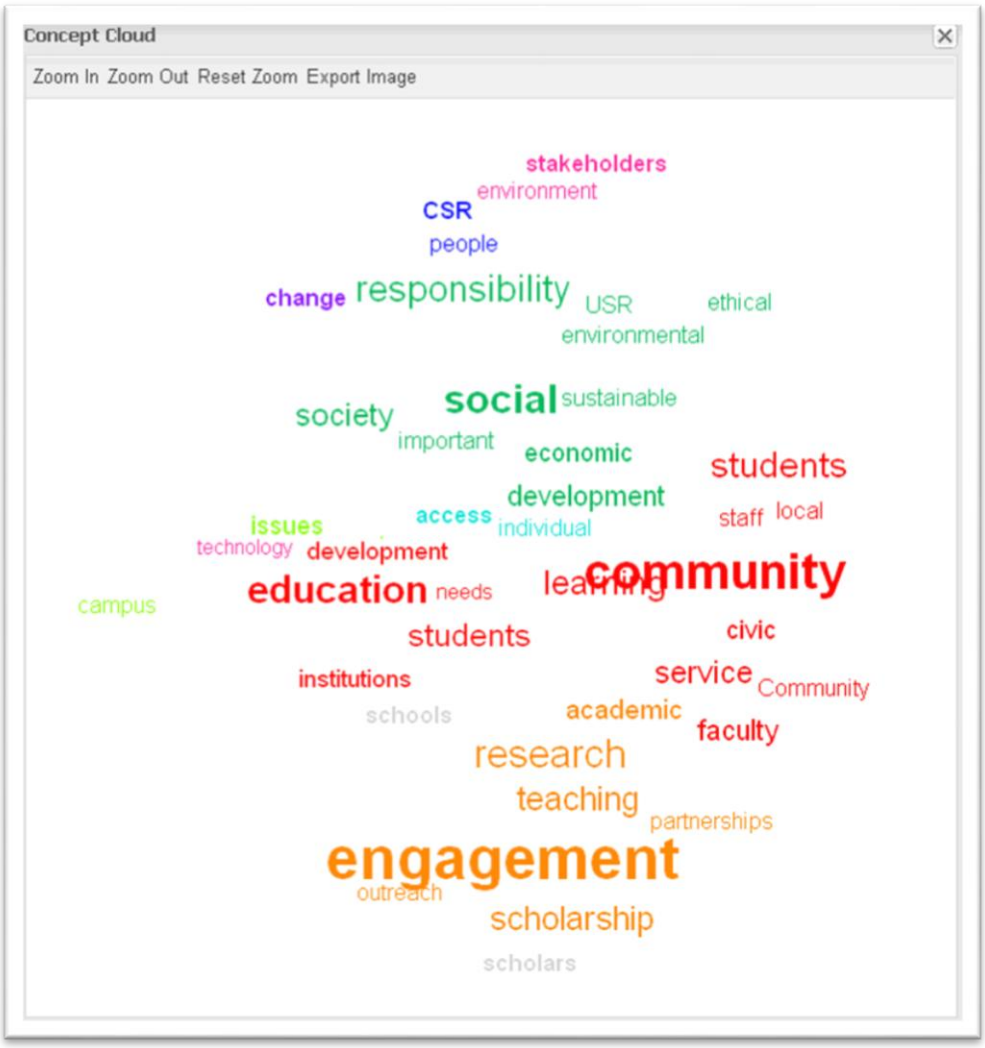


Figure 12-9 The cloud concept considering the whole corpus of data

Bearing in mind the above-mentioned discussions, as well as the inadequacy of automated analyses in taking into account the meaning of words in the specific context and contemplating the conceptual relationships, it is essential to review the machine outputs for identification of the main notions in the context of USR. To clarify the inadequacy of automated analyses, here is an example about words' relationships that the machine is unable to consider while clustering words. In the context of USR, the words such as 'students', 'staff', 'faculties', 'schools', 'scholars', 'academics', 'institutions', 'organisations', 'individuals', 'citizens', and so forth, belong to the theme 'community'. However, none of the content analysis software can consider this relationship. Therefore, to finalise the results represented in Tables 12.2 and 12.4, these sort of relationships need to be considered. To achieve this, the existing corpus was reviewed and the children–parent relationships the boundaries of the theme community were outlined (see Figure 12.10).

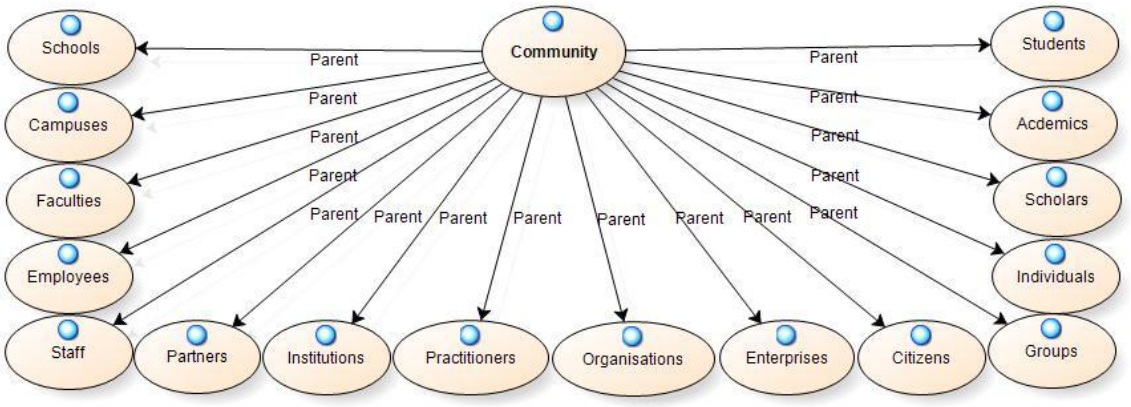


Figure 12-10 Clustering words that belong to the theme 'community'

An analysis of the results obtained from this process reveals that the most referenced notion of USR is 'community' which includes students, institutions, faculties, scholars, academics, organisations, individuals, staff, citizens, people, schools, etc. The second most prominent notion in this domain is 'engagement', which is the main feature of USR. The notion that is the most referenced (i.e. community) represents the objective of USR activities, and the second most notable concept (i.e. engagement) represents the main characteristic of a socially responsible university. According to the analysis, other prominent notions that form part of or contribute to USR are education, scholarship, learning, research, knowledge, society, service, teaching, environment, change and collaboration.

12.5. Analysing the Body of Knowledge to Identify the Concept Relationships

In the third step of the proposed approach, the corpus is analysed using NVivo and Leximancer to discover the semantic relationships between the main notions of USR identified in step two. Like the previous steps, first the document that contains definitions of USR were analysed. While searching for relationships, the concept maps generated by Leximancer were reviewed in different levels of concept visibility and theme sizes. The concept visibility refers to the number of concepts visible in the map. It is important to clarify that the size of a theme circle here is not the identifier of its prevalence or significance in the text; the coloured circles are just borders. The

prevalence in Leximancer analyses were determined by the number of concepts represented in each theme as has been shown in the thematic summary reports. However, the concept maps here are visual representations of the corpus which show the main features of the texts and their interrelations.

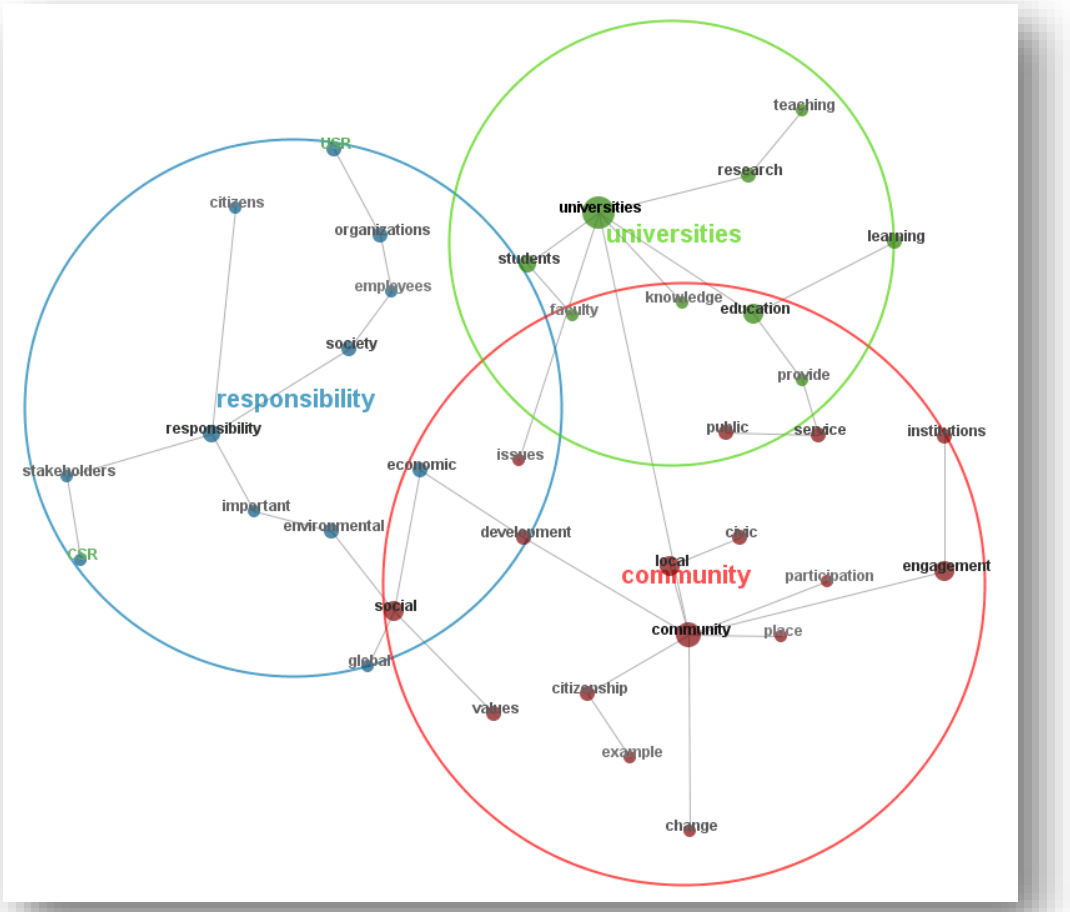


Figure 12-11 Concept map with 100% visibility and 70% theme size

The first concept map illustrated here (Figure 12.11) in the highest level of visibility (100%) and the theme size of 70% shows three main themes (i.e. university, responsibility and community). The words that have been shown in the same theme (coloured circles) are those concepts that have appeared often in the same piece of text. The theme 'community' is highlighted as the hottest theme, which means it has more significance than the other themes. The grey lines show the relationships between different words in the analysed text.

Table 12-5 List of concepts related to the term ‘university’ in the context of USR

Related Name-Like	Count	Likelihood
USR	7	39%
Related Word-Like	**Count**	**Likelihood**
citizenship	13	100%
participation	8	100%
emphasis	5	100%
engagement	42	88%
faculty	7	88%
global	9	82%
service	17	81%
civic	11	79%
strategies	11	79%
definition	11	79%
development	12	75%
example	6	75%
employees	5	71%
place	5	71%
activity	12	71%
values	10	67%
education	26	65%
public	10	63%
students	18	62%
society	16	62%
environmental	8	62%
social	29	60%
economic	11	58%
universities	82	57%
teaching	7	54%
change	8	53%
research	12	52%
learning	13	52%
responsibility	17	45%
knowledge	4	40%
stakeholders	4	33%
citizens	3	33%

University as the main theme in this context has relationships with all the other concepts (Table 12.5). The first column of this table shows a list of words that have links with the theme ‘university’ in the corpus of text. The second column shows the frequency of term segments where each term appeared with the term ‘university’, and the third column illustrates the likelihood of each concept linking to the ‘university’ theme. For example, it shows 88% likelihood for the term ‘engagement’. This means that 88% of the text segments with the term ‘university’ also contain the term

‘engagement’. In this table, the term ‘USR’ is recognised as a proper name (Name-Like). Therefore, it appears in a separate section to show its statistics.

The visual representation of this table is shown in Figure 12.13. This concept map illustrates the terms connected to ‘university’ and their distances from this theme. As can be seen, some terms in the previous table do not have a high degree of likelihood, however they appear to be close to the main theme ‘university’. For example, see the terms ‘teaching’, ‘knowledge’, ‘education’, ‘students’ and ‘service’. This means that these terms appeared in the corpus of text very close to the term ‘university’, however their frequencies are less that some other terms such as ‘citizenship’ or ‘engagement’.

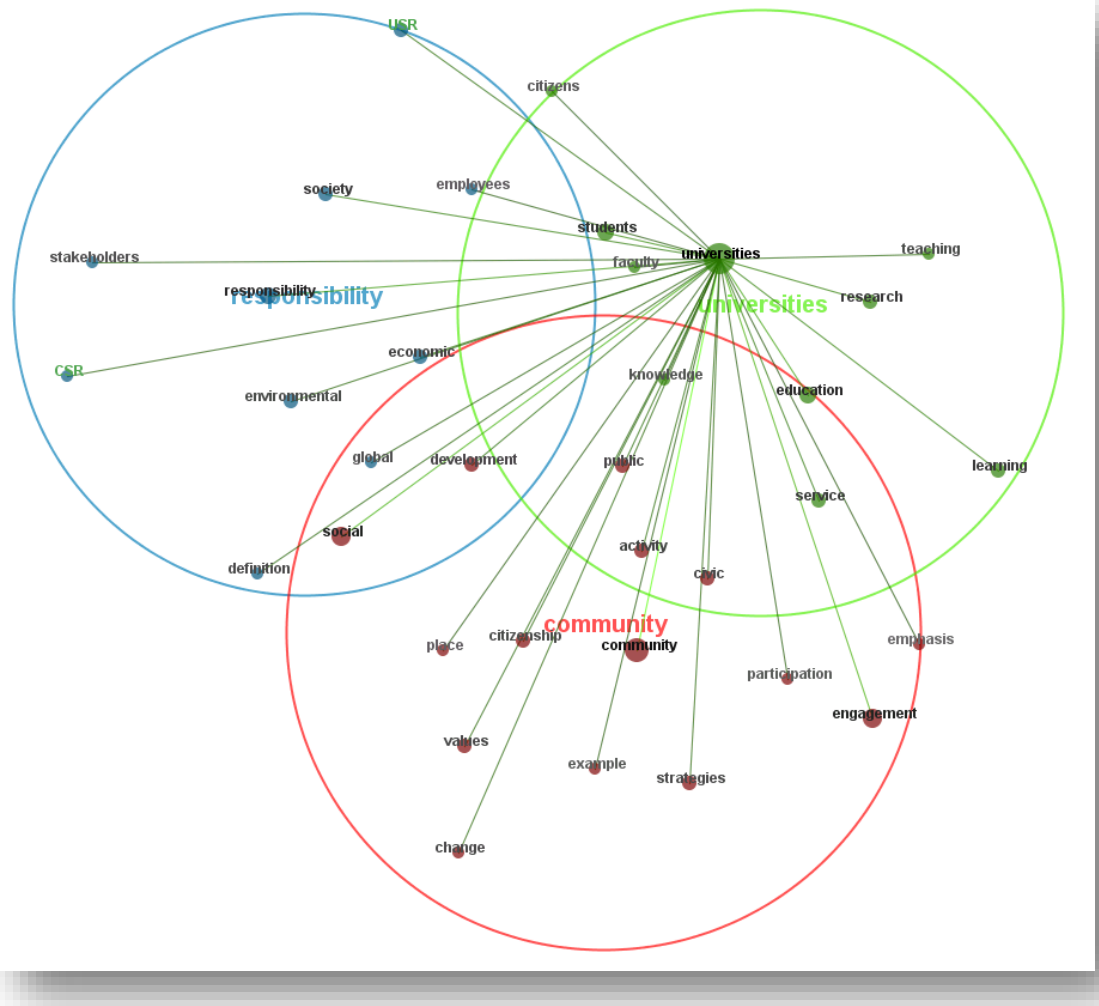


Figure 12-12 Related concepts to the theme ‘university’

It is important to mention that these initial outputs regarding word relationships have been extracted from the word document that contains all existing definitions for the concept of USR. Once again, the word 'university' was eliminated to see how the concept maps demonstrate main themes of USR and their relationships. Figure 12.13 shows the concept map of analysed documents in the highest level of visibility of concepts and the theme size of 35%. As can be seen in this map, the hottest theme appearing in red is 'engagement'. Other important themes according to the USR definitions are 'teaching', 'knowledge', 'scholarship', 'responsibility', 'community', 'social' and 'collaboration'.

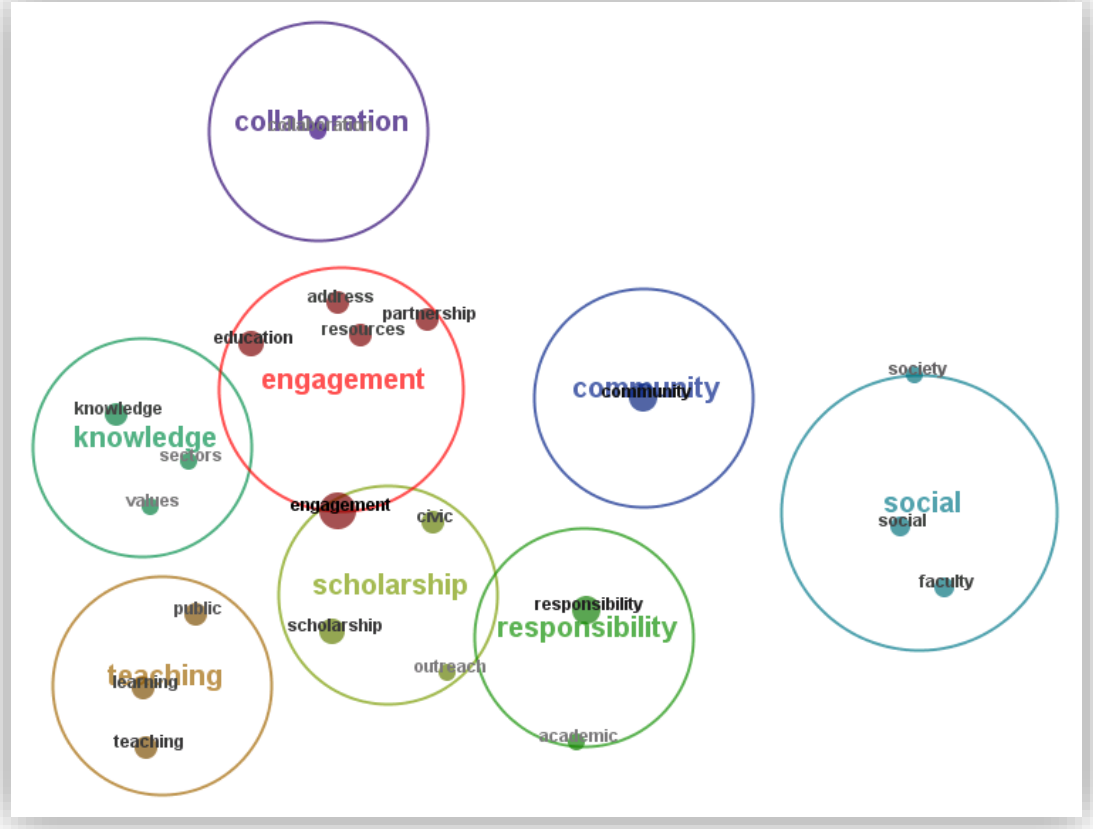


Figure 12-13 Concept map with 100% visibility and 35% theme size

In the second stage, the whole corpus of text was reviewed to see how all the different themes related to each other (see Figure 12.14). Interestingly, the theme 'engagement' again appeared as the hottest theme that linked the themes 'scholars', 'education' and 'community' together. This visualisation is absolutely in accordance with some definitions of USR in the literature where 'engagement' has been discussed

to be the university's mission linking educational activities to the community by involving scholars in community-based teaching and research activities. Another hot theme in this map is 'social' which links 'stakeholders' to 'education'.

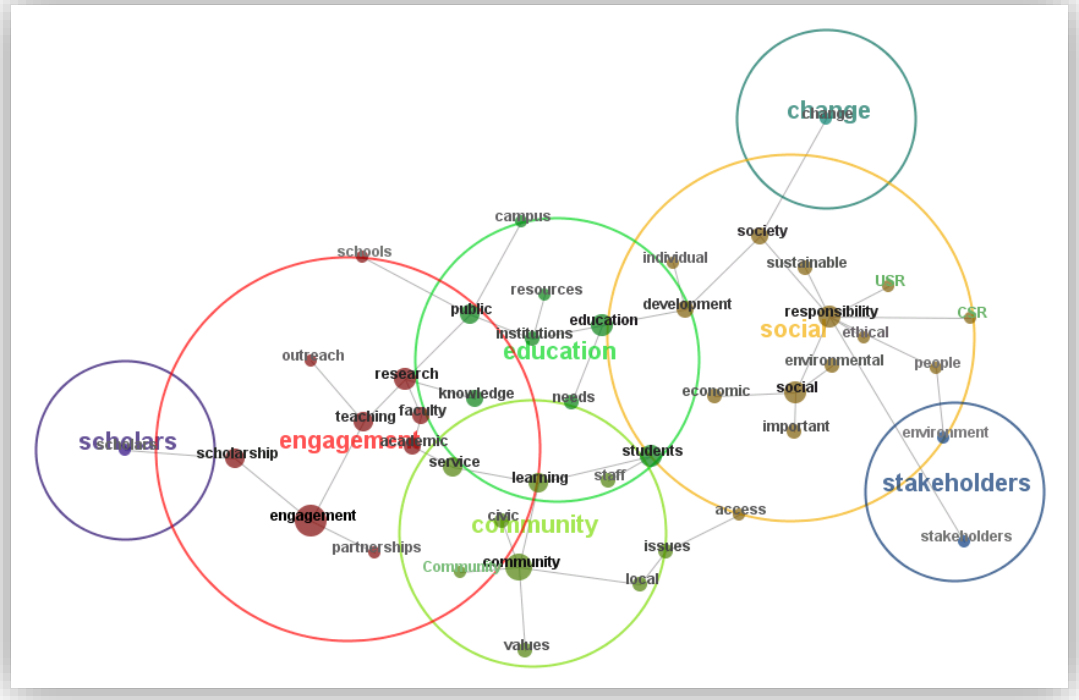


Figure 12-14 Concept map with 100% visibility and 45% theme size

As the representation of the concepts in each theme still seems unorganised and there are some unrelated words in the concept map, the project was revised to locate non-related words in the stop list. The theme 'university' as the main subject and the theme 'community' as the main objective in the context of USR have been stopped to see the relationships between USR's main notions. The result, in this stage, was a concept map (Figure 12.15) which displays the most important concepts that occur within the text (except 'community' and 'university') and their relationships. In these thematic clusters of concepts (coloured circles), the central theme of USR is 'engagement' encompassing minor notions of 'partnership', 'resources' and 'civic'. This final concept map demonstrates that the literature considers 'engagement' to be the main feature of social responsibility of a university. In this context, the main concept associated with engagement is 'education' which contains sub-notions of 'society', 'needs', 'campuses' and 'schools'. As Figure 12.17 shows, other notions of USR are linked to the key notion of 'engagement' are 'research', 'knowledge',

‘service’, ‘scholarship’ and ‘teaching’. These others notions have been emerged in the same distances of engagement, however, the notions of “research” and “service” are represented as two bold themes.

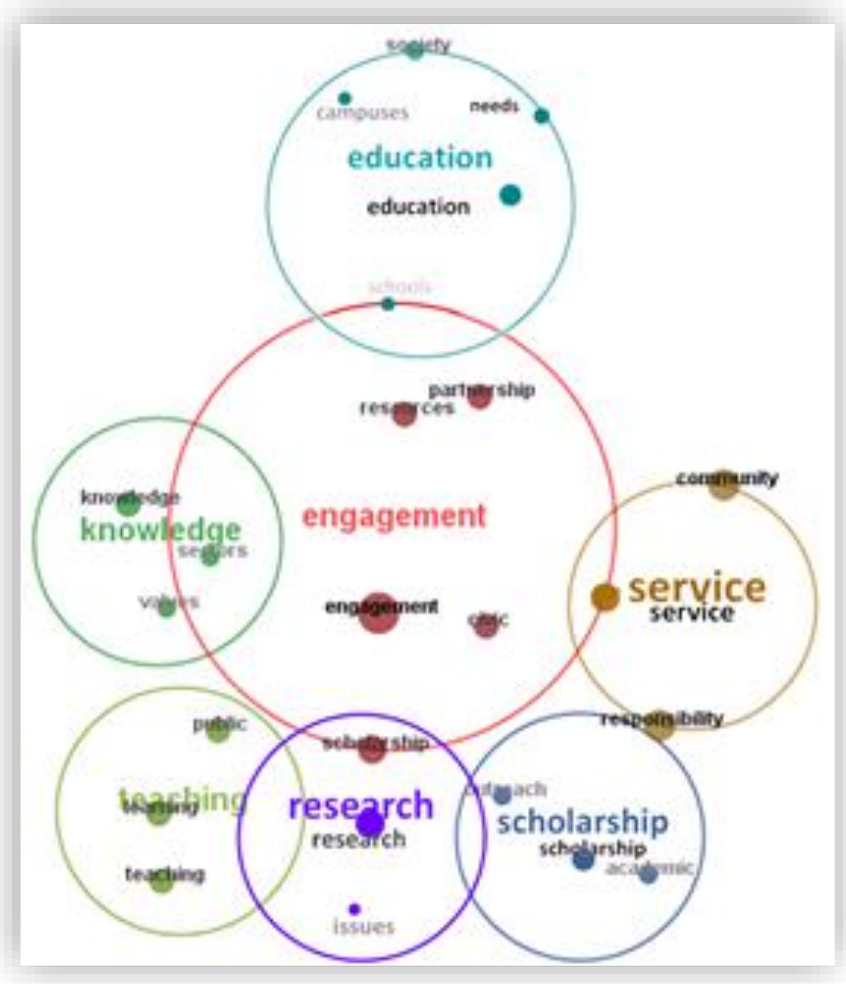


Figure 12-15 Concept map with 100% visibility and 40% theme size base on the whole corpus

As can be seen from the relative diameter of the circles representing these key concepts of USR, the relative strength of the relationship of these concepts to ‘engagement’ is almost the same. Additionally, we can see from the above figure that the diameter of the circle representing the concept of ‘education’ is greater than that of ‘service’, ‘research’, etc., denoting the higher importance of education relative to these concepts. In the next section, a quantitative approach is proposed to capture the relative strength of relationships between these concepts. From this figure it can be concluded that in the literature, USR is described as the university’s engagement and

partnership with its communities which can be achieved through education (transferring knowledge), provision of services, research, teaching and scholarship.

In order to obtain more detailed information about USR and its associated concepts and their relationships, word search queries about the most frequently occurring concepts in Leximancer were run (see Figure 12.16).

Figure 12-16 An example snapshot of word queries in Leximancer using Sentiment Lens

The main purpose of these queries was to discover the context in which the identified themes co-occurred and to investigate the association with each other and with the main subject, which is the university. For example, in this part of the analysis,

to find the relationship between the two themes of ‘university’ and ‘engagement’, by applying the Leximancer Sentiment Lens, 84 phrases across the data corpus were identified in which these two words were presented in association with each other

This sort of analysis was undertaken for all the most frequent concepts (the output of word frequency query in NVivo) and the results were reviewed to extract relationship types (see Appendix A). In order to develop an initial draft of the ontology of USR, each concept identified using step 2, were defined as a node and accordingly the exported relationships were defined using NVivo software. The Models Tool was used to visualise the developed nodes and their relationships and the output were modified to produce an initial ontology model (see Figure 12.17). The initial model of USR ontology generally demonstrates the different functions that a socially responsible university should perform. The map was developed using weighted percentage aggregation for concepts and Leximancer Pair Words Queries’ outputs.

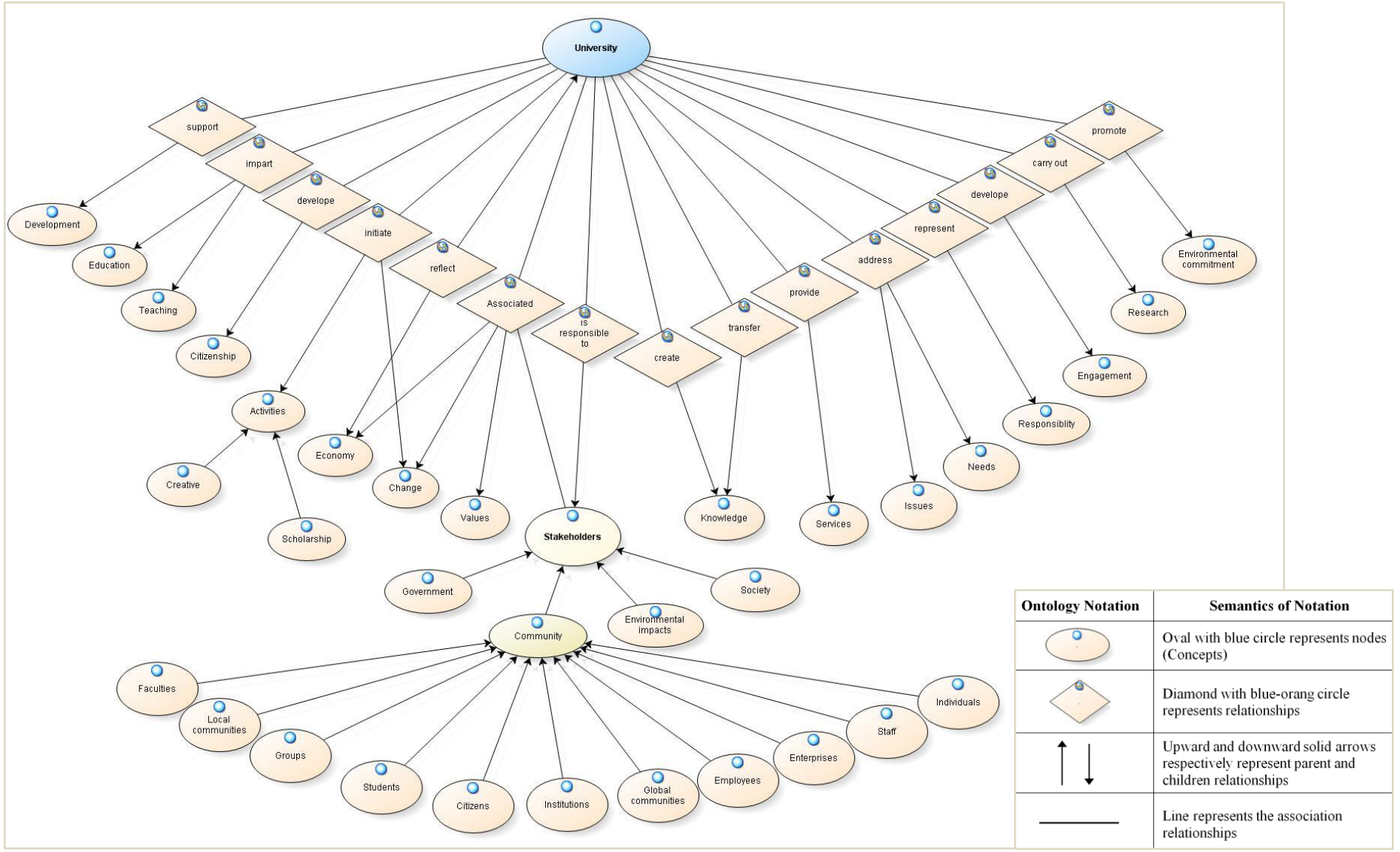


Figure 12-17 The initial USR ontology representing relationships

12.6. Ontology Refinement and Future Evolution

As the main purpose for developing the USR ontology is to outline a general understanding for this concept and to identify its factors and indicators, the initial representation of knowledge regarding the concept needs some refinements. This refinement aims to outline the main factors of the USR concept by which one can quantify the university's commitment to social responsibility performed through three steps.

12.6.1. Merging Common Terms and Relationships

In this step, to refine the ontology, all the weighted percentages of synonymous words were merged to obtain a more precise analysis. The weighted percentage of each word was identified by the content analyses software (NVivo), comparing the frequency of each word in the corpus of data with other words. Some examples of this phase are 'research' and 'discovery', 'ethical' and 'moral', as well as 'service' and 'outreach'. WordNet® was employed to identify synonyms that appear in the ontology.

Furthermore, the weighted percentages of other words, which in this context fall within the same category, were merged. The terms 'academics', 'scholars', 'teachers' and 'faculties' are some instances of words that belong to the category of 'academic staff'. Similarly, the terms 'campuses', 'faculties', 'students', 'staff', 'employees' and 'families' can be categorised under the 'university community'. At a higher level, the terms 'community', 'society', 'government', 'business', 'environment' and 'industry' are all in the category of 'stakeholders'. Considering these semantic relationships, the notion of 'stakeholders' appears to be the most important component of USR in the analysed body of knowledge.

The results revealed that the main indicators of USR in the existing body of knowledge included 'stakeholders' (comprising communities, society, governments, business, environment and industry), 'engagement', 'education', 'research', 'scholarship', 'learning', 'service', 'knowledge', 'teaching' and 'ethics'. The

following equation was used to examine the importance of a concept *k* within a group of n concepts:

$$\boldsymbol{I_k = \frac{W_k}{\sum_{1=1}^{n} W_i} \times 100} \qquad \text{Equation (1)}$$

Where I_k is the importance of concept *k* in the group; W_k is the weight of concept *k* among all the concepts; while the denominator represents the sum of weights of the concepts in the group. The importance of each concept is shown Table 12.6. Appendix B shows more analyses regarding the weighted percentage of notions obtained from NVivo.

Table 12-6 The most frequent concepts of USR, their weighted percentage and importance

USR Components	Weighted percentage	Importance
1. Stakeholders	9.96	48.75%
2. Engagement	2.77	13.56%
3. Education	1.35	6.61%
4. Research/discovery	1.32	6.46%
5. Scholarship	1.32	6.46%
6. Learning	1.16	5.68%
7. Service/outreach	1	4.89%
8. Knowledge	0.79	3.87%
9. Teaching	0.55	2.69%
10. Ethics	0.21	1.03%
Total	20.43	100.00%

It should be mentioned that in the analysed literature, USR is defined and described as the engagement between a university and its stakeholders through its functions of education, research and services. In the obtained results, education is considered the main function of a university and encompasses other functions like knowledge transfer, teaching and learning. In this step, the refined version of the USR ontology is depicted in Figure 12.18.

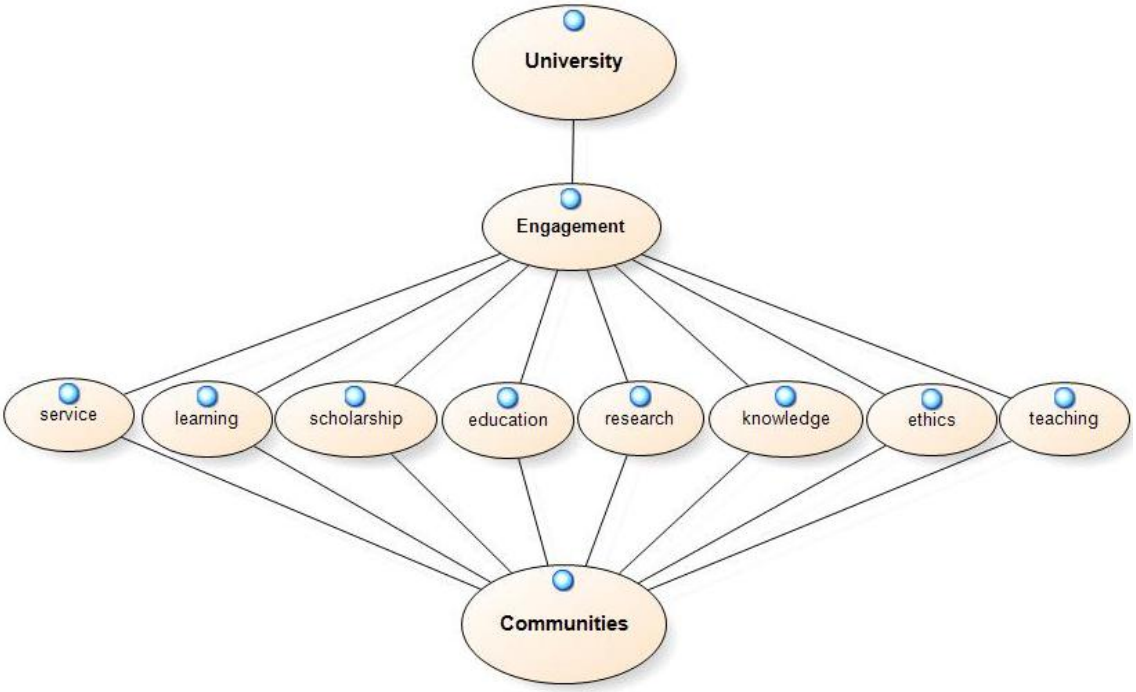


Figure 12-18 General view of USR as discussed in the literature

As shown in this figure, based on the ontology refinement process as applied on the initial developed ontology, a socially responsible university engages with its communities (stakeholders) through service provision, imparting education, teaching-learning process, research activities and ethical conduct. In this view, there are still some overlapping concepts (e.g. education, teaching, learning, knowledge, scholarship) which refer to the most well-known university mission, which is known as teaching-learning, or even advancement of knowledge (Fear, Rosaen, Fishman, & Bawden, 2001; Hall, 2009; Millican & Bourner, 2011). Therefore, these overlapping concepts which refer to the main mission of higher education will be merged in one category, namely ‘education’.

12.6.2. Cross-examinations to Identify Missing Concepts

In the next step of ontology refinement, the literature was examined to find missing concepts. In a cross-examination of the literature, it was found that one of the important principles of social responsibility, as is declared in the ISO 2600 guidelines, is transparency of the policies and activities (ISO/DIS 26000, 2009). This component is also highlighted in the USR framework which was developed by the USR Alliance founder (Sawasdikosol, 2009). However, the results show that this critical factor is

missing in the investigated literature. The reason for the omission might be that 'transparency' is considered a key concept when describing USR, but its relative importance when considering SOE and UCE is much less so. As a result, when analysing the, USR definitions and associated terms, it appears as a missing concept, since the analysis takes into account the frequency of terms.

12.6.3. Add the New Concepts to the Ontology

Therefore, to finalise the USR ontology, transparency is proposed to be one of the USR factors defining the accountable relationships between the university and its stakeholders. The resulting USR ontology is shown in Figure 12.19. The visualisation of the ontology is depicted from NVivo outputs considering USR notions and their associated terms as well as their relationships. As Figure 12.19 shows, in USR ontology there are a number of main notions, such as education, research, service, ethics, transparency and engagement, by which USR can be explicitly defined. Some of these concepts have other interrelated notions that are significant in a general understanding of USR concept. Once all these concepts are defined, the formal explicit description of the concept is ready to be a reliable basis for measuring the USR concept across universities. These key concepts and their definitions have manually been extracted from the literature and have been modelled.

Table 12-7 The ontology notations

Ontology Notation	Semantics of Notation
	Oval with blue circle represents nodes (concepts)
	Double arrow represents interrelationships
	Upward and downward solid arrows respectively represent parent and children relationships
	Line represents the association relationships

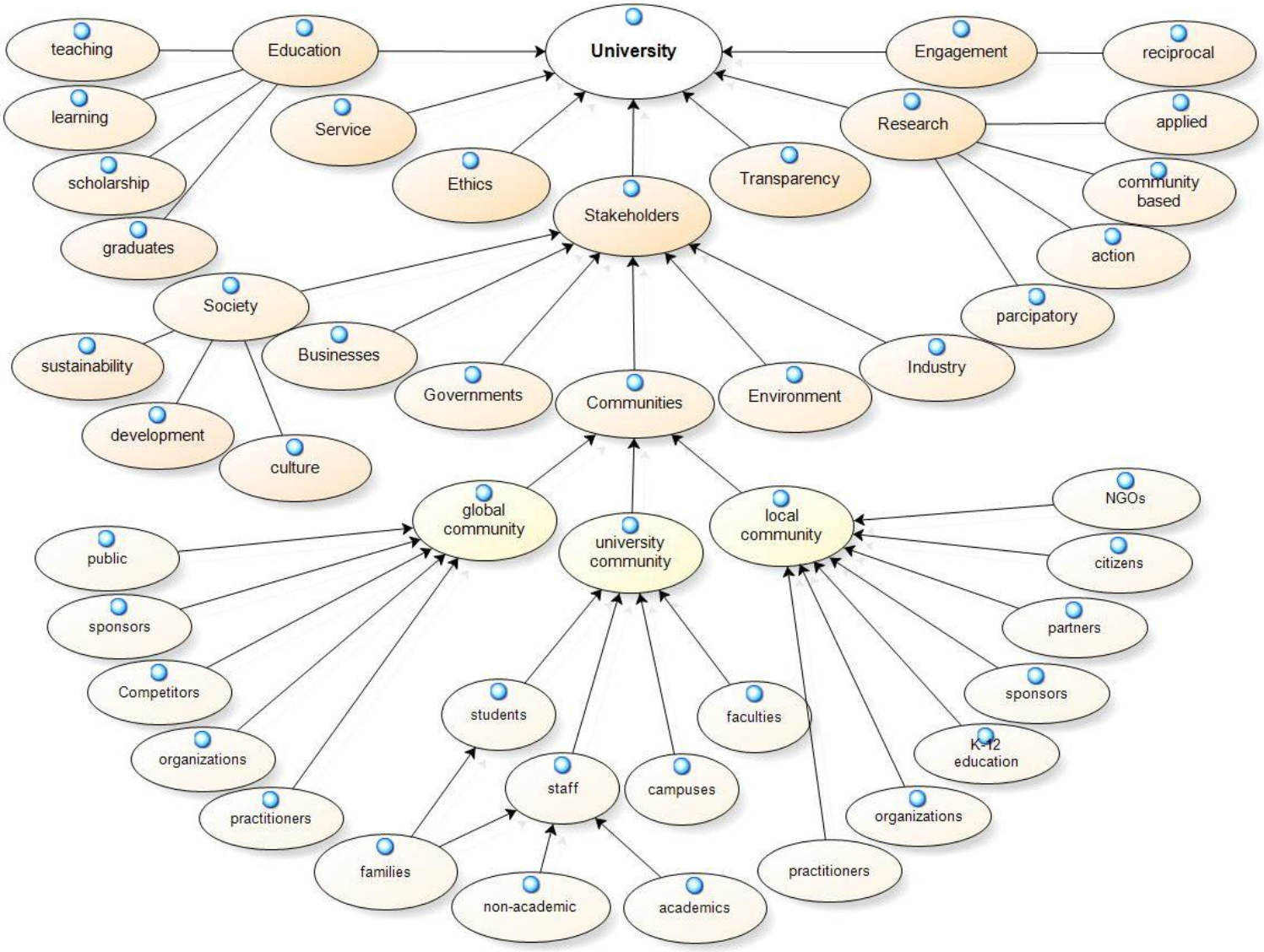


Figure 12-19 The final visualisation of the USR ontology according to the corpus of text

12.7. Conclusion

In this chapter, the ontology design for social responsibility and the USR, as well as the VUSR were proven, using the SAOD method illustrated in Chapter 4. Text-mining approaches, including NVivo analyses, word frequency counts, words cluster map, word clouds, theme visibility and statistical methods were used. These tools and technologies underpin the social responsibility/USR/VUSR ontology design, the statistical approach included over 800 articles from scholarly databases, scientific publications in journals and conferences and internet resources as shown in the literature review. It is believed that this results in the world's first ontology of social responsibility and USR, as well as VUSR.

Chapter 13_ Design and Implementation of the Knowledge-sharing Portal for USR and VUSR

13.1. Introduction

In the previous chapter, the researcher outlined the fuzzy logic based metrics which will be employed along with the measurement framework to construct the VUSR measurement methodology. These proposed tools and techniques need to be evaluated, therefore, the VUSR measurement prototype system needs to be developed. This chapter outlines the system structure; therefore it will provide details about different phases of the implementation of the engineered VUSR measurement prototype.

In the following section the overview of this system will be presented and the flow of control within the different phases of the prototype system will be explained in detail. Section 13.3 will define the initialisation phase of the prototype system and the tasks involved. The foundation phase of the prototype system will be outlined in section 13.4. Then, the third phase of prototype system which is data collection will be presented in two steps including students' survey and staff survey. will be represented in sections 13.5. Section 13.6 will present the finalization phase of the prototype system. In each section, all the tasks which are associated with each phase will be defined. The chapter will then be concluded.

13.2. The VUSR Measurement Prototype System

In the previous chapters, different parts of the methodology by which online universities can measure their contribution to social responsibility have been explained in detail. The ontology-based VUSR measurement framework was employed and the measurement criteria were defined. To ascertain the level of significance of each measurement criterion, fuzzy-based techniques were used and importance values were calculated. Furthermore, the fuzzy logic-based VUSR metrics were proposed enabling online universities to simply use linguistic variables for data collection and translate the input into fuzzy values for the calculation phase.

In order to validate and establish the effectiveness of the proposed methodology, a VUSR measurement prototype was developed. This prototype enables online universities to use the available data as well as staff and students' perceptions to quantify the level of their contribution to social responsibility. The prototype aims to provide proof of the VUSR measurement metrics as outlined in the previous chapters, which is the evidence of the practical stage of system development research methodology as defined in Chapter 3.

The main objective of engineering the VUSR measurement prototype is to enable the researcher to simulate the implementation of the proposed measurement methodology and to show how the system based on this methodology operates. Therefore, the system prototype was developed using PHP language and a database management system (i.e. MySQL). The reasons why these tools were chosen are that both are open source and web-based tools which facilitate knowledge sharing regarding the developed tools and methodology.

The user of this system is supposed to be VU managers who aim to assess the level of their university's commitment to social responsibility. Therefore, the terms 'user' and 'virtual/online university manager' will be used interchangeably. An overview of the prototype is outlined in Figure 13.1 with a focus on the flow of control over it. This system has four main phases, which will be explained in the following sections. Figure 13.2 highlighted these phases using different colours.

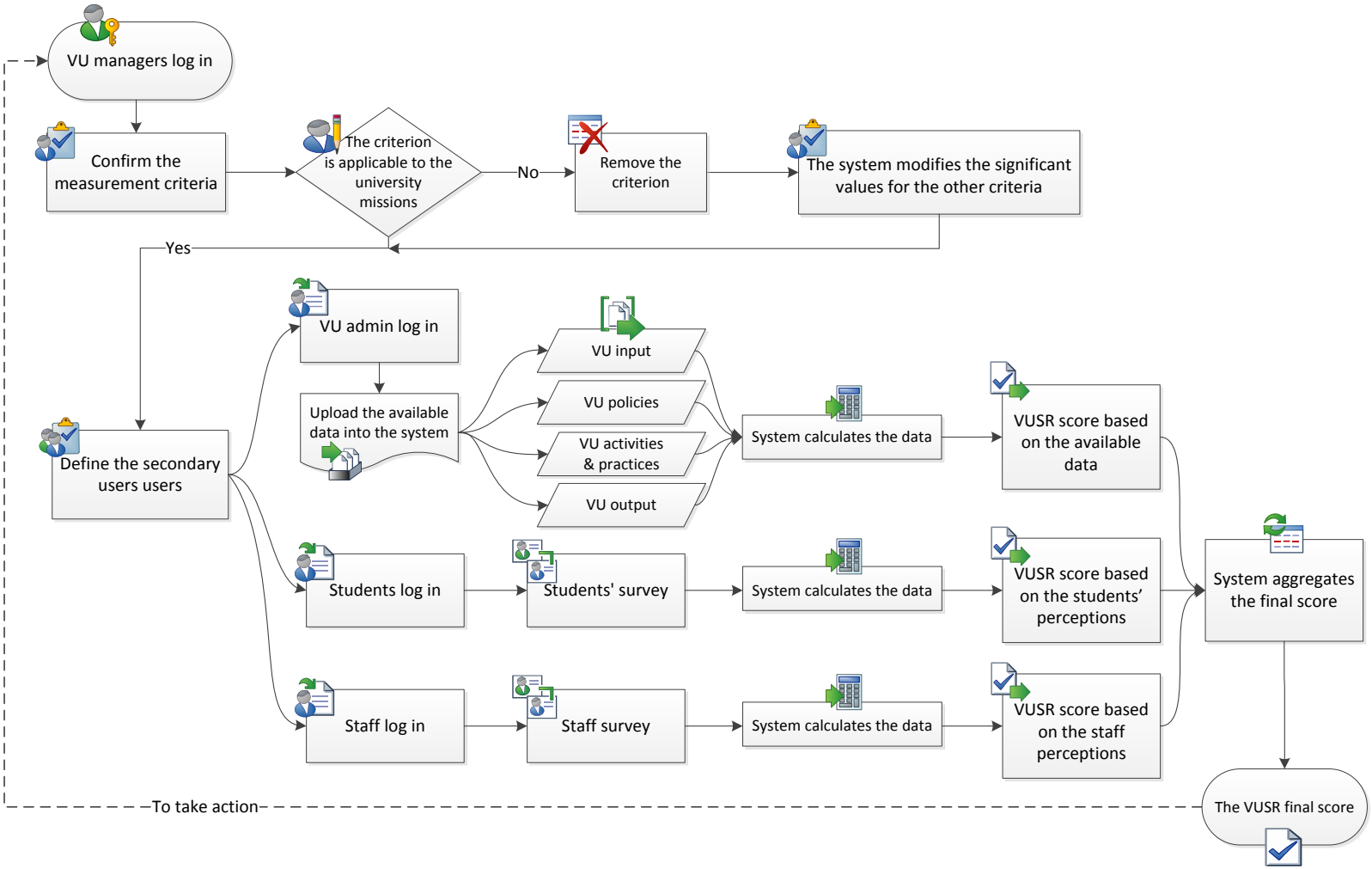


Figure 13-1 The flow of control in the prototype

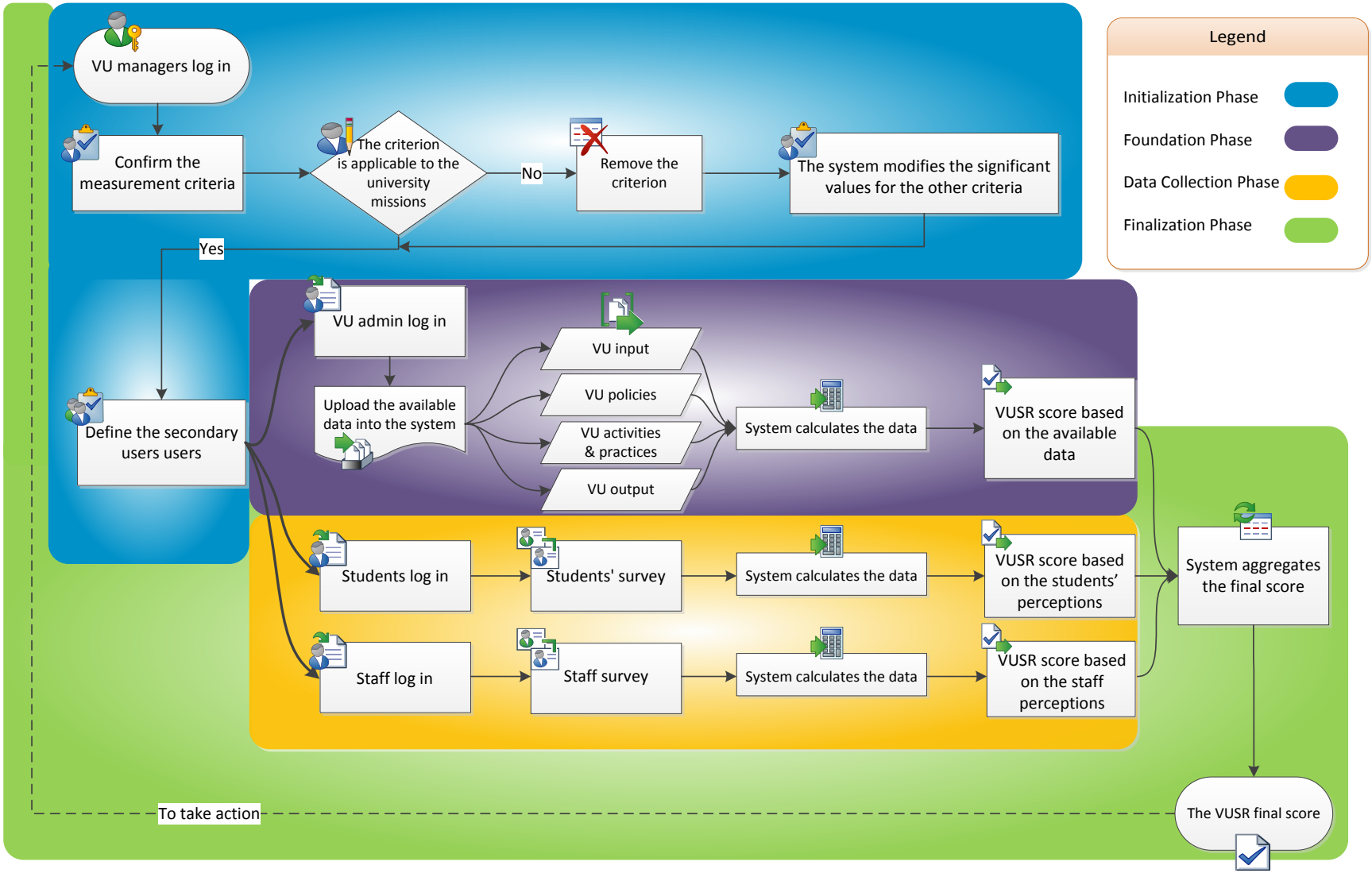


Figure 13-2 The prototype system phases

13.3. The Initialisation Phase

The initialisation phase is the starting point of the VUSR measurement prototype system. In this phase, initially the main user (VU managers) log in to the system to start the assessment process. The university manager needs to decide if all the identified measurement criteria are applicable based on the university's missions. The assessment framework has been defined for an online university which has a trinity of functions (i.e. teaching, research, services). Therefore, if a given university has no research function, in the initialisation phase the main user can eliminate this criterion. It is important to note that just one of the criteria (i.e. research) is the subject of this phase. Due to the definition of online/virtual university as outlined in the Chapter 3, education and service provision are the initial functions of the university that cannot be ignored. Also, two other criteria, i.e. community engagement and transparency, are the special characteristics of a socially responsible university which, regardless of the form of education delivery, should be considered. Therefore, the only criterion subject to elimination in the initial phase of the prototype system is the research criterion.

As in previous chapter mentioned, each measurement criterion has a level of significance which can affect the university's score; therefore if one of the criteria (research) is deleted by the main user, the system recalculates the significance values for the other four criteria. Consequently, the main user needs to do the next task, as shown in the Figure 13.2, to define which stakeholders should be involved in the measurement.

According to the VUSR measurement framework all primary stakeholders, including online students, staff and the university administrators, should be engaged in this process. Therefore, the main user in the initialisation phase defines the secondary users, including the university administrators who have access to the university database, as well as students and staff (academics and non-academics). The VU manager is required to register all these users and provide access to the system for them. The figure below outlines the flow of the control in this phase of the prototype system.

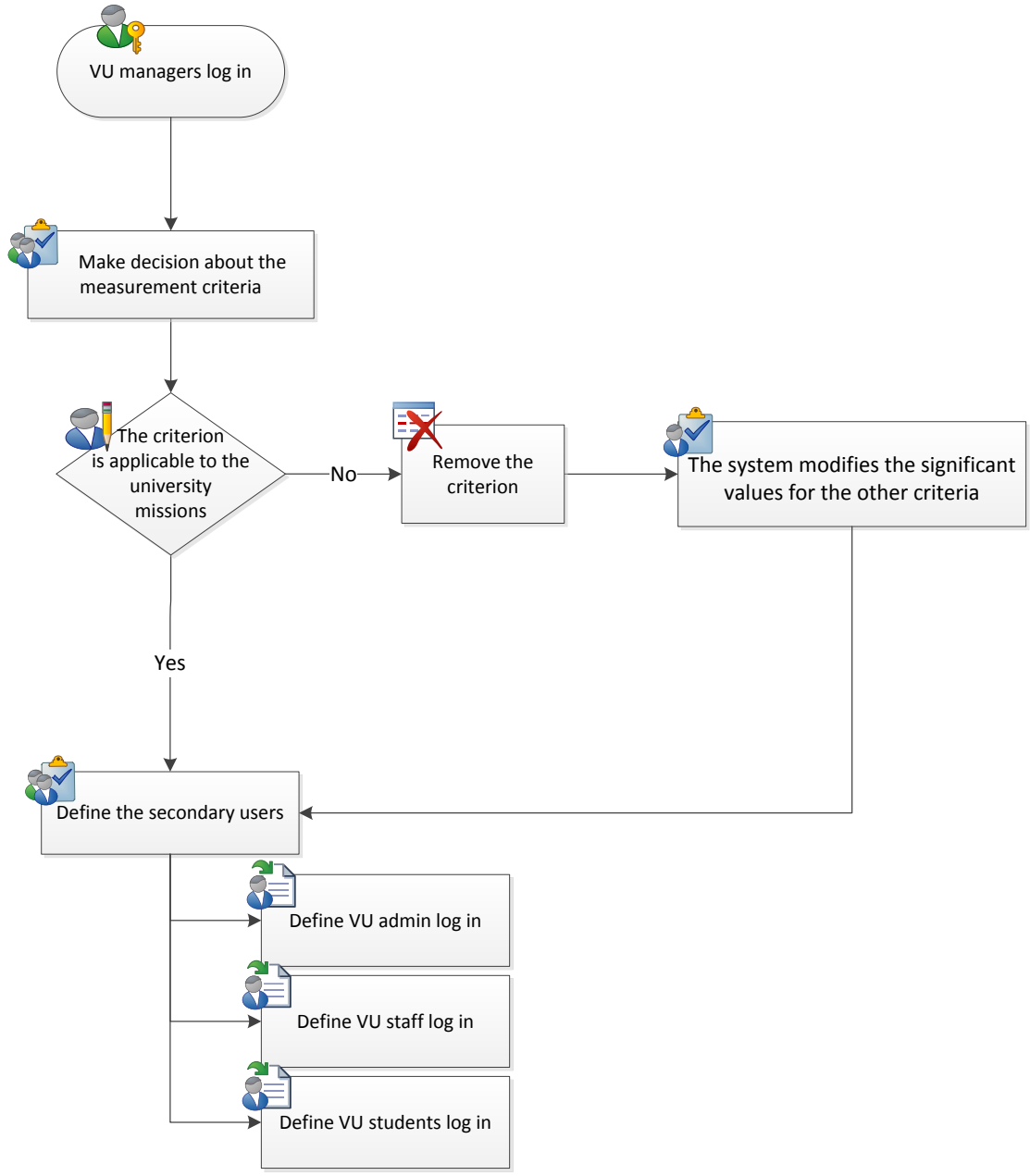


Figure 13-3 The flow of control in the initialisation phase of the prototype system

13.4. The Foundation Phase

This phase of the prototype system involves online university administrators in the process of measurement. In the previous phase, the VU manager defined those university administrators who have access to the required information regarding each

measurement criterion and registered them in the system. This group of users are required to feed the system regarding all sub-criteria that outlined in Figure 13.3. In the developed prototype system, according to the performance attributes of each sub-criterion (see Chapter 9), a list of questions were drawn up that the administrator needs to answer using the available data in the university database. All the items here are questioning the university's input, strategies and policies or output relating to the criteria and administrators can use the available data to feed the prototype system.

This phase, as shown in Figure 13.3, has eight tasks, five of which have been developed to feed the prototype system regarding the five VUSR measurement criteria and all their sub-criteria. Although, this phase aims to incorporate the available data, in some cases, as the measurement performance attributes are qualitative, the university administrators were asked to provide their perceptions regarding the level of university achievement in those areas. In order to answer the questions, the administrators can easily choose one of the options o the seven-point Likert scale, or in some cases indicate an exact value or answer for the questions.

The first task of this phase asks the VU administrator to fill in the field inquiring about the quality of education, quality of graduates, social responsibility education, the university's ethical performance in teaching/learning and the expenditures on education development and improvement. Tasks 2 to 5 similarly involve the university administrator filling in the fields regarding all sub-criteria associated with other VUSR aspects, research, service, engagement and transparency. As can been seen in Figure 13.3, once the university administrator feeds the system regarding each criterion, the system automatically calculates the provided data and reveals the university's VUSR score.

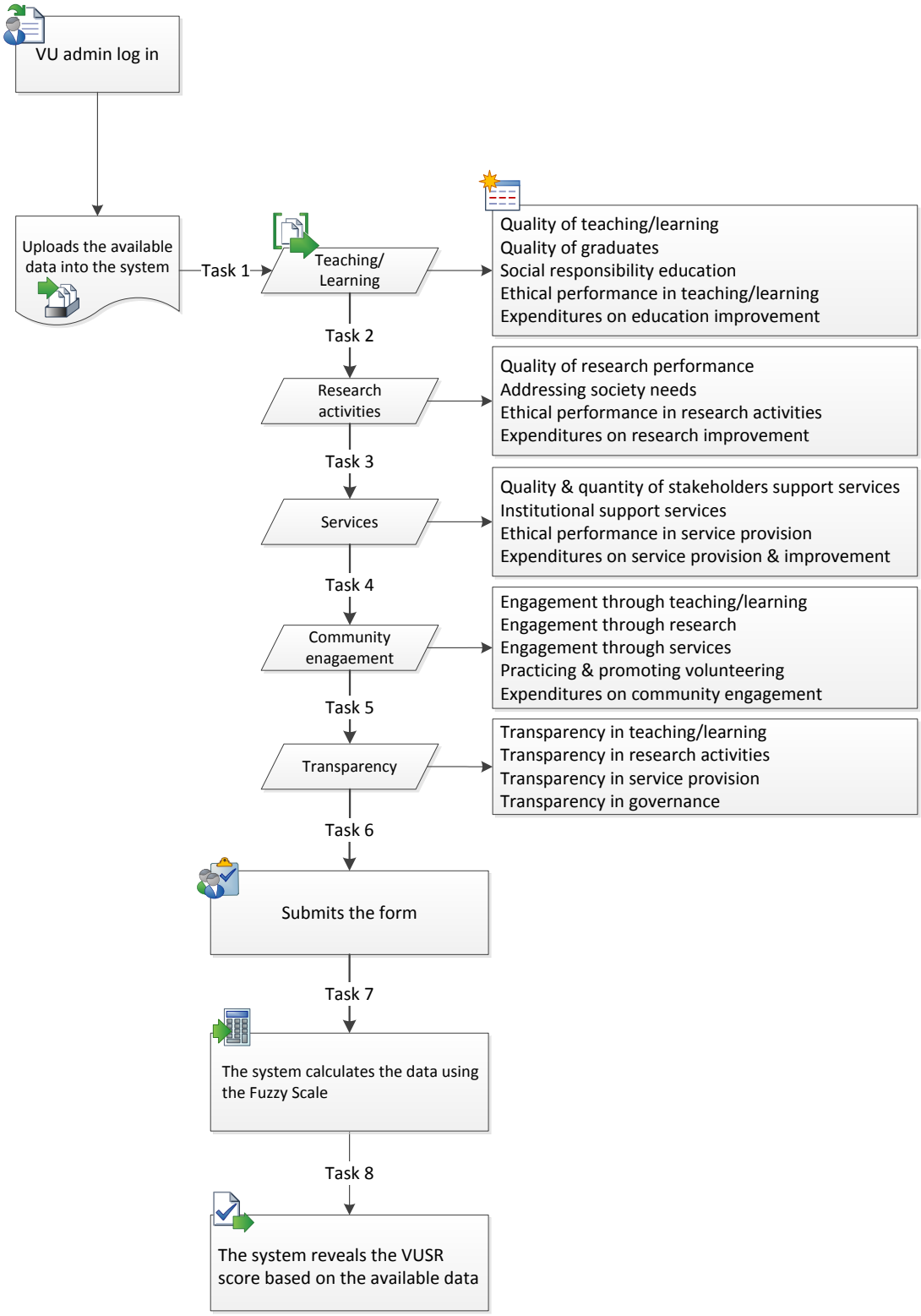


Figure 13-4 The flow of control in the foundation phase of the prototype system

13.5. The Data Collection Phase

The third phase of the VUSR measurement prototype system involves the university's primary stakeholders, including online students and staff. It is expected that the VU manager registered all the online students and staff in the initialisation phase. Therefore, the access link for all students and staff has been provided and they were encouraged to engage with the process. In this phase, any student or staff of the online university is able to connect to the prototype system and undertake the survey, which was designed based on the VUSR measurement framework as outlined in Chapters 8 and 9. This phase includes two steps described below.

13.5.1. Online Students' Survey

The first step of the data collection phase involves students through an online survey. In this survey, the virtual students are required to provide their perceptions regarding their university's commitment to social responsibility in five steps (see Figure 13.4). Apparently, they are not supposed to evaluate the university in regard to all the measurement sub-criteria. As illustrated in Figure 13.4, students were engaged to measure VUSR regarding 10 sub-criteria out of the total 22 measurement sub-criteria as follows:

- the quality of teaching/learning
- the VU's ethical performance in teaching/learning
- the VU's ethical performance in research activities
- the quality and quantity of students' support services
- community engagement through teaching/learning
- community engagement through services
- practising and promoting volunteering
- transparency in teaching/learning
- transparency in service provision
- transparency in governance.

The online students, based on their degree which can be research-based or course-based, have different questionnaires to answer. The students' survey has eight tasks, five of which are in accordance with the five VUSR measurement criteria (i.e. teaching/learning, research, service, community engagement and transparency). In each task, students are asked to provide their perceptions of the university's performance and their online learning experience concerning VUSR performance attributes. All questions are multiple choice with a seven-point Likert scale where students select one point. In each part of the survey, the participants cannot proceed to the next task unless they answered all the questions for the current task.

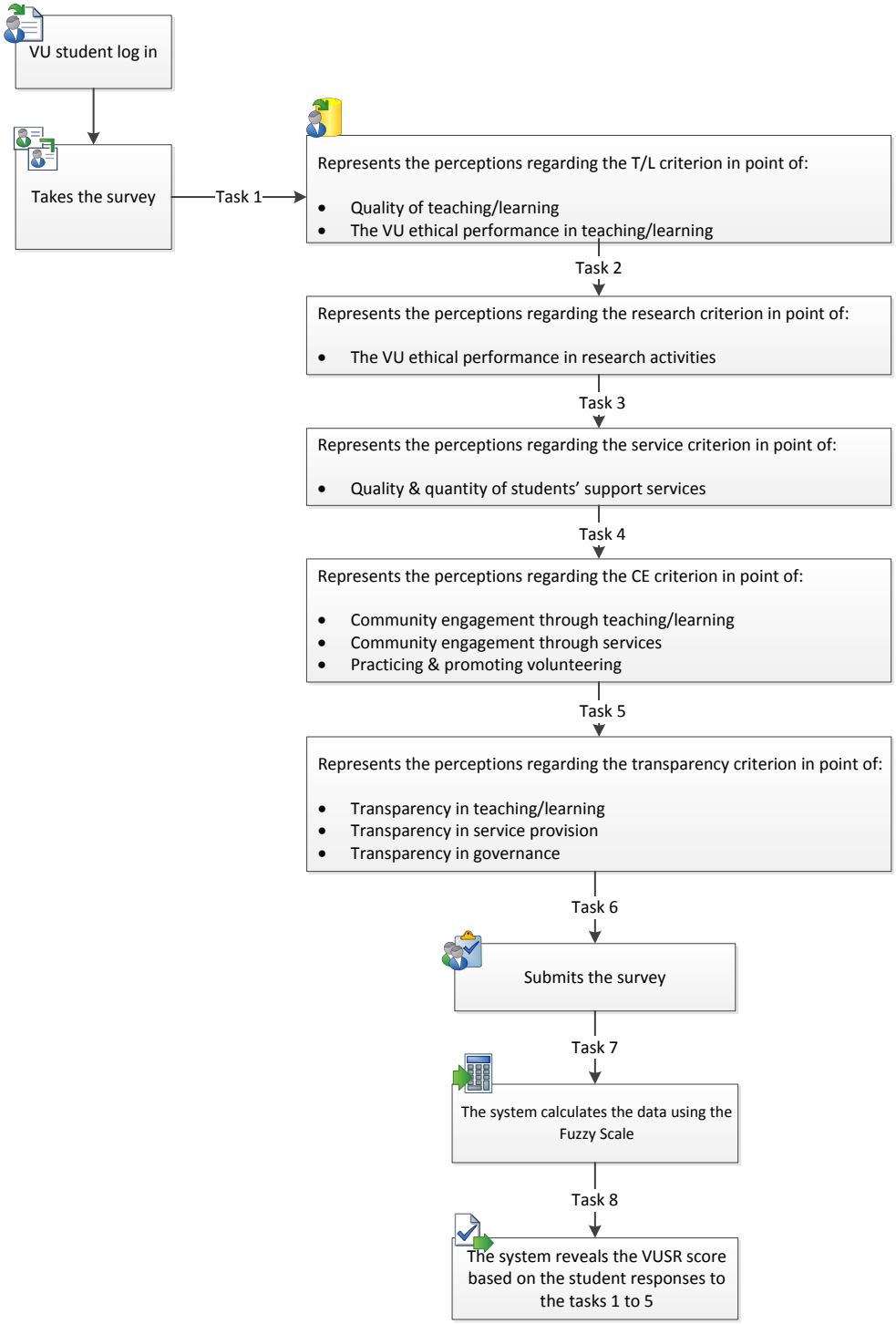


Figure 13-5 The flow of control in the online student survey

In the first task, both groups of course-based and research-based students are required to answer a list of questions about the QOTL. They are also asked about the VU's ethical performance in teaching/learning. Further to the general questions, the course-based students are required to provide their perceptions regarding the online courses, units and learning modules and assessments. Similarly, the research-based

students are also asked specific questions related to the nature of their degree, such as the quality of supervision they receive from the online education system.

In a case where the university has research function, the second task of the survey asks for the online students' perceptions regarding the ethical performance of the university in research (i.e. intellectual property protection). This part of the students' survey appears if the university managers indicated that the VU has a research function in the initialisation phase. Otherwise, after task 1 students are directed to task 3 automatically.

In the third task, all online students are asked to answer the same questions about the quality and quantity of the services they have received from the university, from advisory services in the course selection stage to counselling services regarding career issues. Once students have answered all questions for this task, they are able to proceed to the next task by clicking the 'next' button.

Task 4 was developed to measure the university's community engagement (CE) from the viewpoints of the online students. In this phase of the prototype system, the 'community' refers to both internal (learners and staff) and external (society at large) communities. This step of the survey aims to measure the university's engagement with its communities through teaching/learning activities, services and promotion of volunteering based on the online learners' perceptions.

Task 5 was developed to evaluate how transparent the university is to its students. Therefore, a number of questions were designed regarding the university's contribution to transparency in teaching/learning processes, service provision and governance. When the online students completed this task, the final task for the student is to submit the survey.

By submitting the online survey, the prototype system will calculate all the input based on the fuzzy scale, which was defined in the previous chapter. In this scale, each point in the seven-point Likert scale has its corresponding triangular fuzzy number. Therefore, when the student clicks on the 'next' button, the prototype system uses the fuzzy numbers and calculates the input and provides the output in the results page.

The results page shows the output of the survey in different formats, including numbers showing the university's score in each aspect and the visual representations of the university score based on the student's perceptions.

13.5.2. Online Staff Survey

The second step of the data collection phase in the VUSR measurement prototype system involves university staff in an online survey. Similar to the previous phase, the staff survey has eight tasks, five of which ask for online university staff perceptions regarding the university's performance in different VUSR measurement criteria. As Figure 13.5 shows, staff are engaged to measure VUSR regarding 11 sub-criteria out of the total 22 measurement sub-criteria including:

- the quality of teaching/learning
- the VU's ethical performance in teaching/learning
- the VU's ethical performance in research activities
- the quality and quantity of staff support services
- community engagement through teaching/learning
- community engagement through services
- practising and promoting volunteering
- transparency in teaching/learning
- transparency in research activities
- transparency in service provision
- transparency in governance.

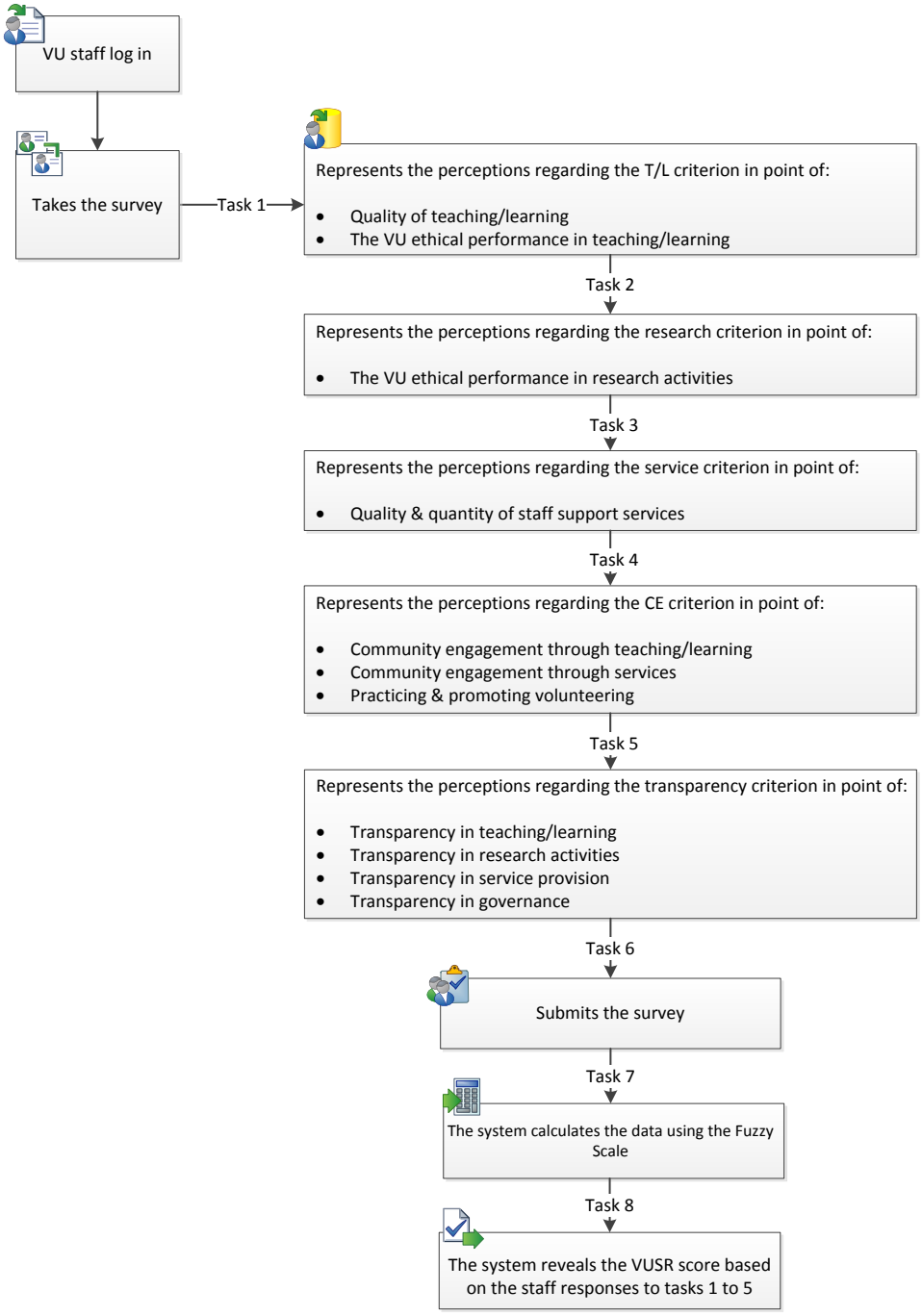


Figure 13-6 The flow of control in the online staff survey

Each of these five tasks has multiple choice questions. In the first task, online staff need to provide their perceptions regarding the QOTL processes as well as the university's ethical performance in teaching/ learning activities. Some of questions in this task directly assess the quality aspects in the online learning system instead of questioning staff perceptions. For instance, the frequency of learning assessment in

each unit or the availability of alternative webpages for visually impaired students are directly assessing the university's practices regarding the quality of education or ethical contribution in teaching/learning activities.

As shown in Figure 13.5, task 2 in this phase like the students' survey has been developed to assess the university's commitment to ethics in its research function. Therefore, as mentioned in the previous phase, if the VU managers defined the university as having a research mission, this task will be activated and online staff will be required to provide their perception regarding the identified fields; otherwise, they will be directed to task 3.

Task 3 in the staff survey was designed to evaluate the university staff perceptions regarding the support services that the VU has provided for them. A variety of fields have been considered in this task, which aims to quantify the level of support provision for staff by the university as well as the level of staff satisfaction with the support services. These supports can be in the form of staff promotion plans, skill development programs, counselling services, etc.

The next step is evaluation of staff perceptions regarding the university's engagement with its internal and external communities through its functions and volunteering practices. Task 4 has 17 questions about three sub-criteria of community engagement that staff are required to answer, before being able to proceed to the next task for the final questions.

Task 5 was developed to evaluate the fifth VUSR measurement criterion (i.e. transparency) from the point of view of online staff. There are 11 questions about the transparency sub-criteria, as defined in Chapter 6. Once the staff answer all the questions, they need to submit the form, however, the prototype system enables them to go back to the previous tasks and revise their answers. Therefore, in task 7 staff can submit the finished form and the prototype system starts the next task.

As explained for the students' survey, in task 7, the system starts calculating input using the fuzzy logic-based scale outlined in the previous chapter. It provides the results in different formats. Hence, the final task of the survey is to reveal the

output for the survey participant. The output is the university's score in each VUSR criterion, the overall VUSR score for the university as well as the visual representation of the scores based on the perception of the staff.

13.6. Finalisation Phase

In the final phase, the VU manager finds the aggregated score regarding their university's contribution to social responsibility based on a variety perspective. It is the university managers' fortune as well as responsibility to consider the output for their future policies and practices. In this phase the system only reveals the results, then, the VU managers should consider these results to decide which aspects and dimensions need more improvement in the future plans.

13.7. Conclusion

In this chapter, the overview of the prototype system of the VUSR measurement methodology was outlined. This prototype system has four main phases including initialisation, foundation, data collection (students' survey and staff survey) and finalization which all have been discussed in sections 13.3 to 13.6. In the next chapter, the researcher employs this prototype system for knowledge sharing and the evaluation of the techniques and the measurement methodology that have been proposed in this thesis.

Chapter 14_ Prototype Evaluation of Knowledge Sharing of USR and VUSR

14.1. Introduction

As can be seen in the previous chapters, based on the USR ontology (Chapters 5 and 6), the ontological representation of the VUSR concept was developed (Chapter 7). The VUSR measurement framework was also designed (Chapters 8 and 9) and was equipped with different measurement techniques (Chapters 10 and 11). In the process of implementation of this framework, as outlined in the previous chapter, a prototype was developed to test the feasibility of the ontology-based measurement methodology. According to the system development approach, this enabled the researcher to validate the proposed methodology though the prototype system as a proof of concept of the ontology-based VUSR measurement methodology.

Therefore, this chapter aims to implement the prototype system in a case study to see how the measurement methodology will work in a real-world scenario. To achieve the aim, this chapter starts with the given guidelines for using the methodology in a VU setting, allowing methodology evaluation through a simulation. The methodology requirements for VUSR evaluation, prototype demonstrations, will be provided in section 14.2. In section 14.3, the prototype system, considering its tools and objectives, will be defined and will be followed by the system demonstration in section 14.4. In section 14.5, the knowledge-sharing and exploration portal for the VUSR ontology as the basis for the measurement methodology will be illustrated. Finally the conclusion of this chapter will be provided.

14.2. Methodology Requirements

In this section, considering the research issues defined in Chapter 3, the methodology requirements will be defined. Based on the methodology requirements, prototypes are made and demonstrated in a later section. The methodology requirements are:

- the underlying knowledge representation platform
- the knowledge-sharing facilities
- platforms for the measurement framework.

14.2.1. The Underlying Knowledge Representation Platform

The first requirement of the methodology for VUSR metrics development is the underlying knowledge representation platform. Misunderstanding and misinterpretations of the metrics elements are the key issues of communication and precise measurement in the VUSR metrics. Therefore, the methodology requires an underlying knowledge representation platform as one of the elements in the prototype system to facilitate clear understanding and communication regarding different aspects of the metrics and their relationships (criteria and sub-criteria). As the ontology generation has been recognised as a solution for knowledge representation, it needs to be included in the prototype system.

14.2.2. The Knowledge-Sharing Features

The system also requires facilities for the people engaged in the measurement process to share their insights and ideas and put values on the ongoing progress of the work. This aspect can enable improvements of the VUSR metrics for future use based on real stakeholders' points of view. Therefore, the prototype system should have knowledge-sharing features to enable different users (students, staff, VU managers, etc.) to make comments and provide their insights regarding different aspects of the VUSR and its quantification.

14.2.3. Platforms for the Measurement Framework

As the last methodology requirement, it is necessary to put the proposed measurement framework into practice to demonstrate the benefits of the system. The platforms demonstrate how the VUSR measurement system interfaces appear to the users and work in a real scenario.

14.3. The Prototype Knowledge-Sharing Portal System

The prototype system for the VUSR metrics is comprised of the VUSR ontology portal and the VUSR measurement tool with all its associated techniques. A number of tools were employed to engineer this prototype system, all of which will be defined in this section. The purposes for which this prototype has been developed will be discussed subsequently.

14.3.1. Description of the Tools

This section provides the implementation details of web-based portal for the VUSR metrics. The important tools and technologies are as follows:

- Hozo[7] Tool: Hozo is an ontology development tool which was especially produced to generate heavy-weight and well thought out ontologies. In this research, Hozo5.2.36 was used to create the VUSR ontology. This tool comprises of three major features including ontology editor, ontology manager, and ontology server. The ontology editor in which an Onto Studio is dedicated to facilitate ontology-building. It provides environment in which users build and use ontologies. The ontology manager which enables users to manage collaborative projects where they built ontologies in a distributed environment through the internet

[7]. http://www.hozo.jp

with other partners. The third feature i.e. the ontology server provides the environment in which all the ontologies and instances will be stored.

- PHP (Hypertext prepressor):[8] PHP is a popular general-purpose scripting language especially suited to web development. PHP 5.0 was used for development of the business logic and algorithms for VUSR Metrics Web-based Portal.
- MySQL Server:[9] MySQL is the world's second most widely used relational database management system which is open-source. The MySQL Server 5.1 was also employed as a relational database server to store and retrieve information for the web-based portal.
- Apache Web Server:[10] Apache Web Server is software that delivers web content that can be accessed through the internet. In this study, the Apache Server 2.1 was used to deploy VUSR Metrics Web-based Portal.
- LibChart Library:[11] This is a PHP library for rendering bar graphs. This library was used to display the results of VUSR metrics to the users.

14.3.2. Objectives for the Prototype System Development

The aim of engineering the VUSR metrics prototype system was to simulate the working of the ontology-based VUSR measurement methodology. The web-based VUSR metrics prototype system receives input from different users and accordingly represents the VUSR score in five different aspects. In order to enable detailed analysis and detailed validation of the proposed ontology-based measurement methodology, the following supplementary objectives were considered:

1. To provide proof of the concept for the VUSR ontology as the basis for the VUSR metrics in such a language that enables knowledge sharing around the concept in the web environment.
2. To provide the knowledge-sharing features for the VUSR portal by which different university stakeholders as well as experts in the field can

[8]. http://www.php.net
[9]. http://www.mysql.com
[10]. http://httpd.apache.org
[11]. http://naku.dohcrew.com/libchart/pages/samplecode

be engaged and exchange their ideas and knowledge regarding the VUSR ontology and its measurement framework for future use.

3. To verify whether the measurement methodology can accurately compute the input that users provide and display the results of the VUSR metrics to the users, including the VUSR score in each aspect as defined in the concept ontology.

In order to achieve the first objective, the Hozo tool was used to generate the proposed VUSR ontology. Then the generated ontology was placed in the web-based VUSR portal. In order to achieve the second objective, besides sharing the developed ontology in visual and OWL languages, a blog was configured within the VUSR portal. All users involved with the VUSR portal, as well as those interested to the field, can share their comments in the VUSR portal blog. Finally, to achieve the last objective, the data collection tool targeting five different groups of users (university stakeholders) were developed through tools such as AHP, MySQL and Apache Web Server, as defined earlier. The LibChart Library was also employed for the representation of the results in visual formats.

14.4. The Prototype System Demonstrations

In this section, the researcher attempted to simulate a real-world scenario where a VU was using the VUSR metrics prototype system. In this regard, an administrator, a member of the academic staff and a student from the same VU were recruited to use the prototype system. The main purpose was to demonstrate how the user could use the metrics and if the prototype system works. The users were registered by the system's admin in the initial stage, enabling them to enter the system. The registration process in the real-world scenario would be performed through the registration page of the prototype system, as can be seen in Figure 14.1, with the assumption that the VU managers facilitated it for all the university staff and students.

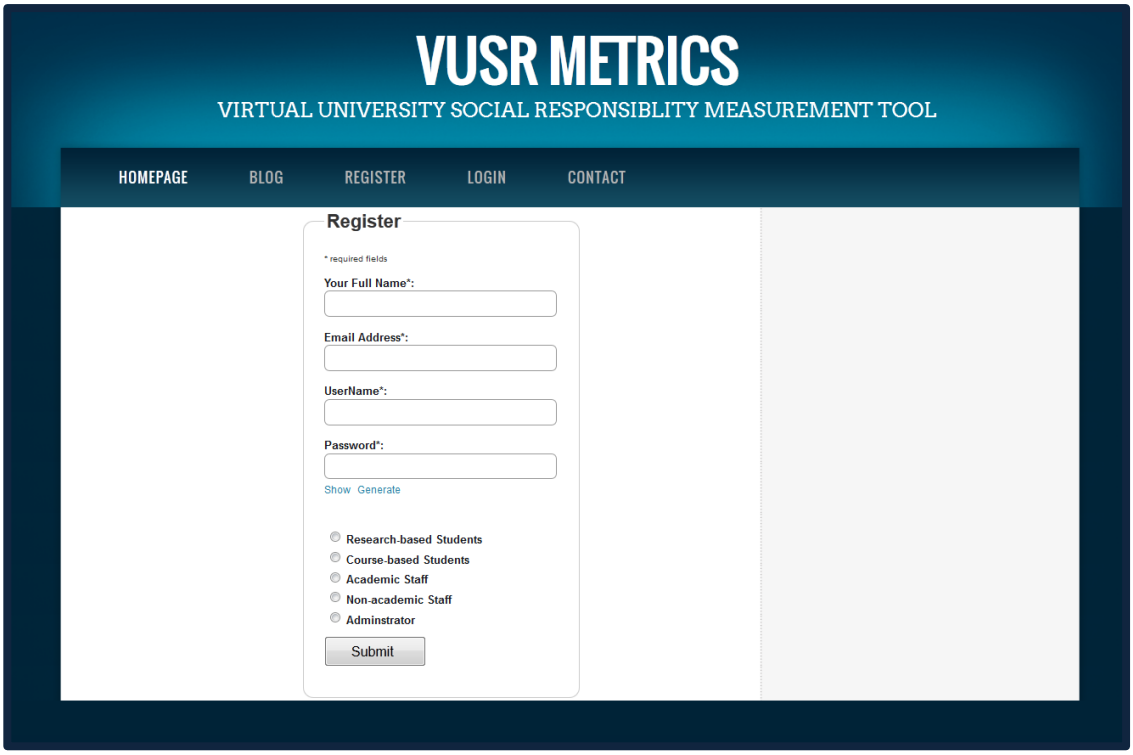


Figure 14-1 The screen shot of the registration page in the prototype system

Once the users registered in the VUSR metrics portal, Figure 14.2 appeared, which acknowledged the registration and directed them to log into the system. The VU stakeholders could log into the VUSR metrics portal once they have been registered. This happened through the log in page, as demonstrated in Figure 14.3. An important feature of the log in page is to identify the role of each user, because it will direct her/him to a different path accordingly. The registered user may log in as many times as they wish, the final input will be saved and considered in the system.

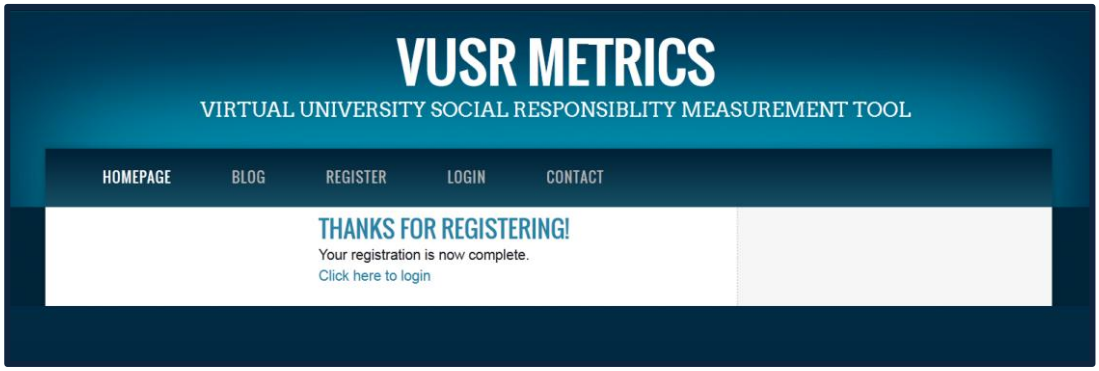


Figure 14-2 The screen shot of the acknowledgement page in the prototype system

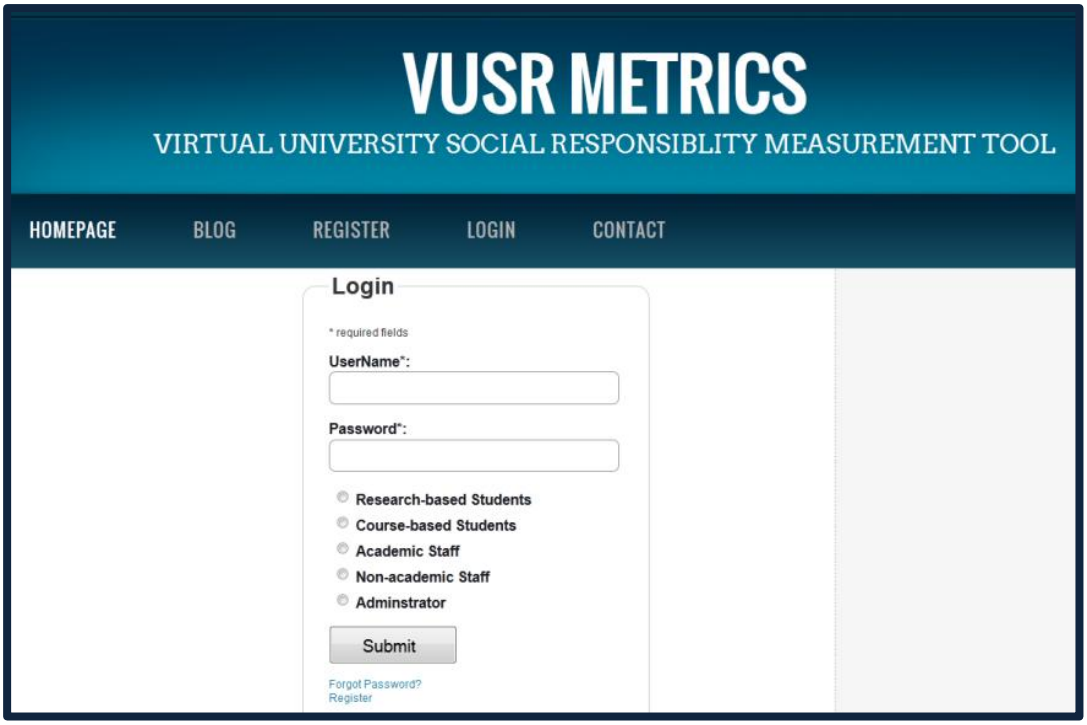


Figure 14-3 The screen shot of the log in page in the prototype system

In the prototype system, as has been discussed in the previous chapter, there are customised wizards for different users enabling the VUSR measurement from different perspectives. These perspectives include research-based students, course-based students, academic staff, non-academic staff as well as administrators. The 'forgot password' feature was also implemented for this page.

The customised wizards were configured based on the phases described in Chapter 12 – the initialisation, foundation and data collection phases. Figure 14.4 illustrates a sample snapshot of the data collection phase, which is aimed at surveying academic staff's perspective regarding the education (teaching/learning) aspect of VUSR in the ethical dimension.

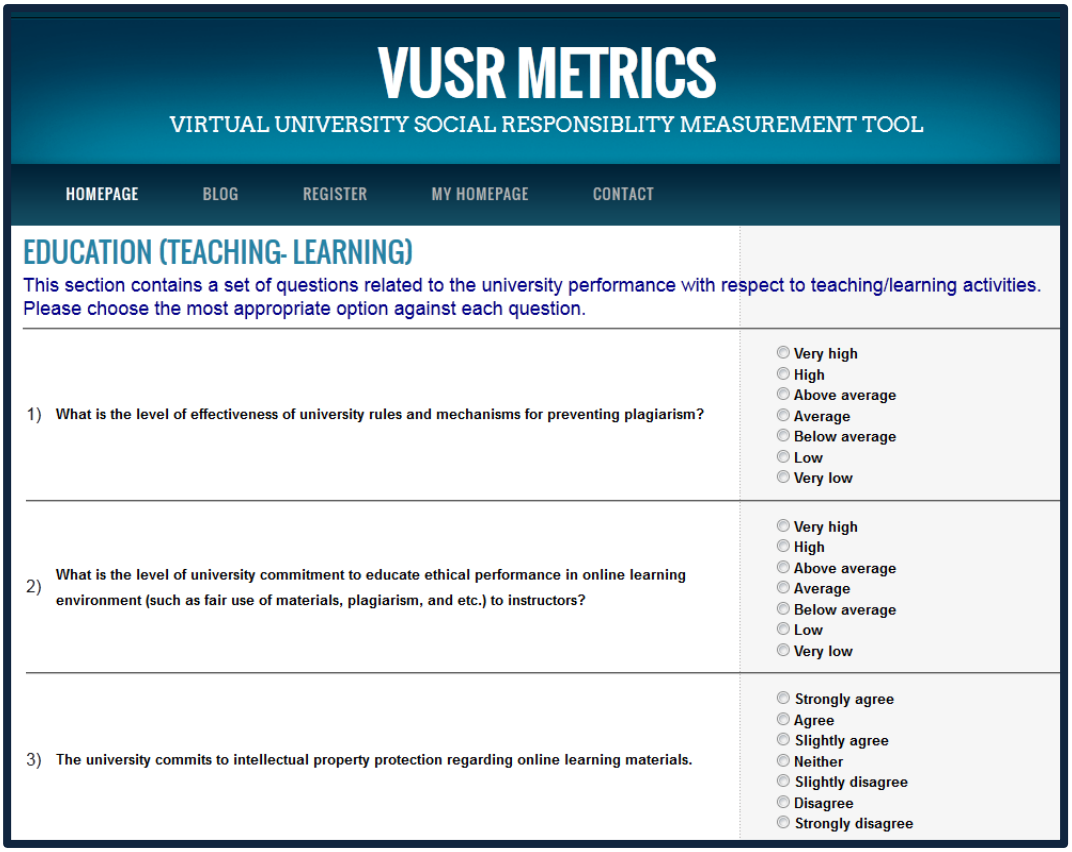


Figure 14-4 The screen shot of the first page of the staff survey in the prototype system

In the prototype system all users, including the university administrators, staff and students, after entering the data in five steps, are able to see the results, i.e. the university's social responsibility score in each aspect in two formats. The results are displayed in numbers as well as graphs. As mentioned before, to verify how the prototype system works, a sample of university stakeholders from a specific VU were asked to use the VUSR metrics portal.

Figure 14.5 shows the results page based on the simulation and the VUSR metrics portal usage. As can be seen, the portal analysed users' input and displayed the VUSR score in each aspect. Based on the input, the results page for this practice shows the first aspect, i.e. education (teaching/learning), to be in the highest level (with the score 0.389) and transparency as the lowest one (with the score 0.039). Note that the input used in this simulation from one university was fabricated to allow evaluation and verification of the methodology. A very small sample of users for the practice was

used only to perform proof of concept, representing major features of the methodology.

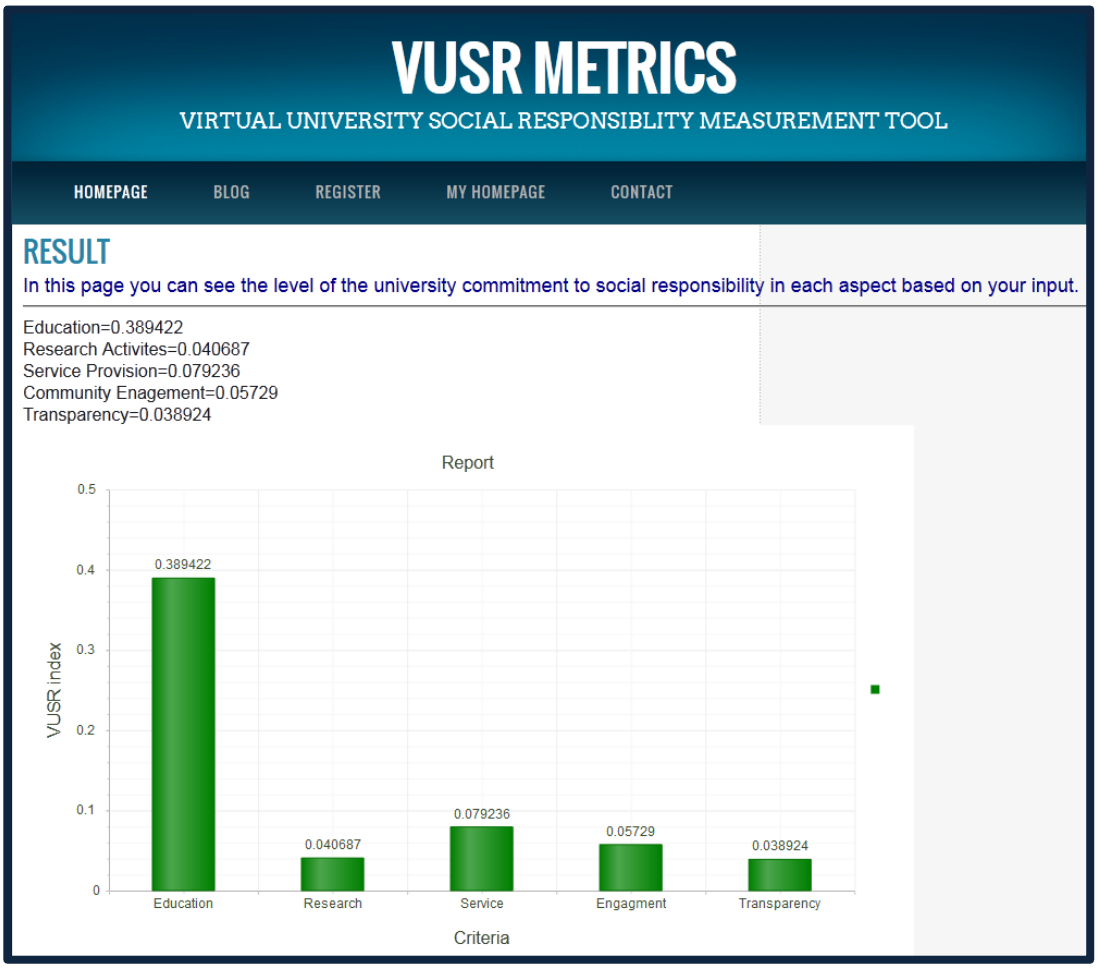


Figure 14-5 The screen shot of the results page in the prototype system

It is worthwhile mentioning that the prototype is not fully completed and suitable for commercial use, instead, it is a sample of the ontology-based VUSR metrics fabricated to allow evaluation and verification of the methodology. It was been used to carry out proof of concept, demonstrating the main features of the measurement methodology.

14.5. Knowledge-sharing and Exploration Portal

The knowledge-sharing portal is proposed as one of the requirements of the VUSR metrics which aims to provide the basis for knowledge sharing regarding the main concept of this research. Therefore, the VUSR portal can be used as an online knowledge dissemination channel which can provide an opportunity for VUs to plan lifelong learning that benefits from different stakeholders' perspectives and experts in the field at low cost.

Since ontologies have been defined as a means for sharing and reusing knowledge (Simperl, 2009), the body of knowledge created regarding the VUSR definition and its measurement framework needs to be shared through an information platform. In this thesis, therefore, a knowledge-sharing portal was established which enables different users in the domain of VUSR to participate interactively to further knowledge development in the field.

In the VUSR ontology, the aspects of VUSR that a VU needs to consider and their associated concepts and relationships have been divided into five levels. Figure 14.6 shows the three levels of the first aspect, which is education (teaching/learning). This ontology has been generated in the Hozo tool based on the Chapter 7 of this thesis. The complete version of the ontology will be presented in the Appendix C.

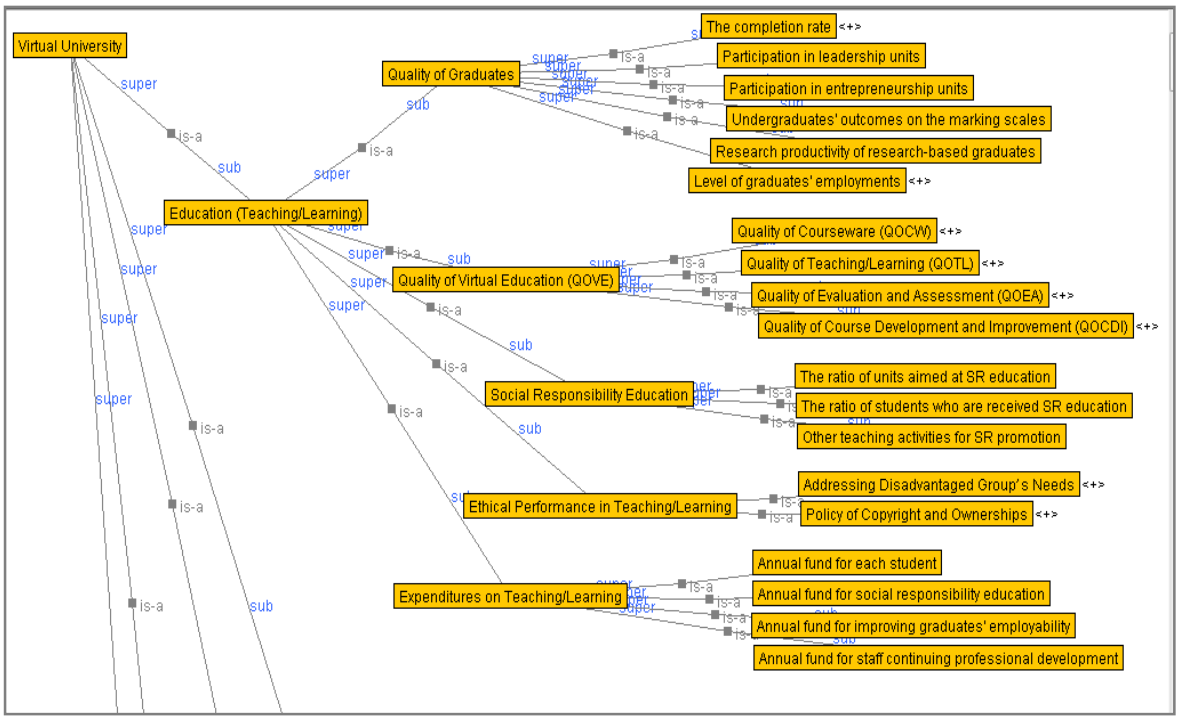


Figure 14-6 The screen shot of the VUSR ontology

The VUSR ontology aims to provide the formal representation of the concept and to capture the domain knowledge by identifying the main concepts of the field and their relationships. This ontology was engineered into languages – human as well as machine understandable language. Therefore, it can be used for semantic annotation, dissemination and assimilation of the domain knowledge.

Ontology has been recognised as an important means for sharing knowledge, organising the knowledge and facilitating its dissemination (Woods et al., 2006). Therefore, the developed VUSR ontology enables the sharing the created knowledge in an effective manner, which assists smarter communication around the concept. To achieve this, the VUSR ontology has the knowledge-sharing portal embedded in the VUSR metrics portal which is accessible through the Homepage. The knowledge-sharing portal provides the ontology in languages understandable by both machines and humans.

14.6. Conclusion

In this chapter, the researcher provided more details about the VUSR metrics portal and the implementation of the prototype system in a real-world scenario. In this regard, the requirements of the methodology as well as the tools and objectives of the prototype system have been defined. The chapter also presented demonstrations of the prototype system and the knowledge-sharing portal as proof of the concepts. The VUSR metrics was implemented with a very small sample to see how the system works in a real-world scenario. The next chapter will recapitulate the whole research and highlight the contributions of this thesis.

Chapter 15_ Recapitulation and Future Work

15.1. Introduction

The concept of social responsibility of universities has been widely discussed in the literature and a number of approaches have been proposed for benchmarking and evaluation of the concept in conventional universities. However, when it comes to the online university context, the literature contains no contributions outlining and quantifying the concept in its totality. However, because of challenges that online universities face, such as a lack of trust and acceptance from stakeholders, it seems crucial to contribute to their social responsibility and manage the university's commitments through measurement. It should be mentioned that in the online education literature there is no attempt to define the concept of USR outlining its entire components. Consequently, the literature lacks a measurement framework and methodology for VUSR.

In order to overcome this gap, and to develop a measurement framework and methodology for the concept of VUSR, the researcher identified six research issues and addressed them. Section 15.2 of this chapter recapitulates these issues which will be followed by section 15.3 representing the list of issues that this thesis addressed. The outcomes of the thesis will be mentioned in section 15.4. Then, the contributions that have made by this research to the literature will be highlighted in section 15.5. Then section 15.6 will provide insights for future work in this area and section and finally, section 15.7 will conclude the chapter.

15.2. Recapitulation

The universities' commitment to social responsibility is one of the significant aspects of the higher education sector that has received considerable attention from both academics and practitioners. In the higher education literature, attempts have been made to define the scope of the concept and to quantify the universities' contributions to their society from this aspect. Contributors to this field of research, based on their definitions of the concept, focused on some components and quantified the concept, while neglecting other components. It is important for the measurement of USR to have a comprehensive definition of the concept in which all the components have been addressed. The researcher noticed that the existing literature failed to present a general understanding of the concept of social responsibility considering its different components in VUs. Consequently, there is no measurement methodology for the concept for quantification of the online universities' social responsibility.

The overview of the thesis and its scientific content include:

Chapter 1 carefully defined and clearly distinguished the common interchangeable concepts of distance learning, online, open, cyber and virtual universities. It also gave a high-level definition of social responsibility, CSR, USR, and VUSR.

Chapter 2 provided a thorough review of the literature related to the main concept of this research, which is social responsibility. It reviewed the concept of social responsibility in the general context, in the online education context and its measurement approaches. This review covered the existing measurement approaches for social responsibility in the general context as well as the higher education setting. Due to the lack of measurement approaches regarding the social responsibility of online universities in its totality, the contributions that measured one or two components of the concept were included in the literature review. The researcher provided a critical review at the end of each section to highlight the shortcomings of the literature.

Chapter 3 outlined the research problem for which the researcher firstly provided the definitions of the key concepts associated with the problem definition. Then the research problem is formally defined. The researcher broke down the research problem into a number of research issues, which this study aimed to address. These issues are defined and then, the research methodology and approach suited to dealing with the issues is outlined.

Chapter 4 firstly defined the technical terms that are associated with the solution overview in order to define the conceptual framework and present the solution overview for the highlighted issues. In this chapter, the approach of the thesis is discussed. Then, the chapter proposed the overall solution as well as the overview of solutions for each research issue. The approach of the study to develop the USR ontology is discussed at the end of this chapter.

Chapter 5 provided the ontological definition of the USR concept. To achieve this, the chapter firstly defined the proposed SAOD approach and employs it to generate the ontology based on the body of knowledge extracted from the literature. The output of this approach i.e. the USR ontology was employed to define the sub-notions of the USR concept. Further, this chapter contains the comprehensive definition of the USR based on the ontology.

Chapter 6 provided the definition for the USR ontology aspects. The ontological representations of these aspects, which are parts of the generic USR ontology, are outlined. The output of this chapter is the generic USR ontologies which have been drawn up based on the existing body of knowledge.

Chapter 7 aimed to inherit and extend the USR ontology to be applicable for VUs, as the output of previous chapters (i.e. the generic USR ontology) cannot be directly employed for measuring the concept in the online education setting. The chapter presented the literature analyses regarding USR aspects in the context of VUs, and the ontology-based VUSR representation and its detailed components based on the context of online VUs.

Chapter 8 presented the framework and methodology for the measurement of VUSR though the use of the ontology-based VUSR representation. VUSR measurement is presented as a hierarchy of a number of measurement criteria dimensions, and evaluation of each of these criteria dimension along three other dimensions – social, economic and ethical. This chapter also presented detailed information about the indicators and assessment criteria for each measurement criterion.

Chapter 9 provided comprehensive details of measurement indicators and performance attributes along each of the indicators in the VUSR measurement framework. The chapter represented details of the VUSR performance attributes associated with the measurement indicators along each of the identified measurement criteria. This is followed by a comprehensive description of the performance attributes for each indicator of each criterion along social, economic and ethical dimensions.

Chapter 10 presented a relative measurement model using AHP by which the VUSR measurement criteria can be prioritised, aggregated and computed to obtain an overall figure of merit of VUSR, so that different VUs can be compared based on their performance against the measurement framework of social responsibility. The chapter also presented case applications of the pairwise comparisons in the Expert Choice software in case in which a number of universities are the purpose of VUSR measurement.

Chapter 11 presented two soft computing techniques for prioritising the VUSR measurement criteria, considering the fuzzy nature of the concept. Further, it provided the fuzzy scale for measuring VUSR considering the uncertainty of its associated judgments. The mathematical rules based on which the fuzzy scale will work and the different types of fuzzy variables of the scale are also defined.

Chapter 12 defined the details on the verification and validation of the social responsibility ontology which is the base of the VUSR measurement framework. In this regard, the chapter represented the detail view of the ontology development approach and its refinement.

Chapter 13 outlined the knowledge-sharing portal design for the ontology of the VUSR concept. It presented, illustrated and explained the VUSR prototype system with the knowledge-sharing portal of VUSR and its measurement.

Chapter 14 provided further details regarding the implementation and simulation of the prototype knowledge-sharing portal with the developed VUSR measurement methodology to validate and demonstrate how the proposed methodology works. In order to validate the effectiveness of the VUSR, case study and data are used for the measurement and demonstration of the knowledge-sharing portal.

15.3. The Issues Addressed in this Thesis

In the course of the current research documented in this thesis the broad issue to be addressed is to develop the VUSR measurement methodology that enables online university managers and VU learners to measure the social responsibility considering all its dimensions as defined in this thesis. In order to address this issue, a number of problems have been addressed in this research as follows:

1. To define the concept of social responsibility formally in the context of tertiary education based on the existing body of knowledge and to outline the ontology concepts. Also, based on this ontology to identify and define the concept components and its dimensions in the context.
2. To develop an ontology and definition of the USR concept in the online education setting. The implementation needs to take into account the specific characteristics of the online education environment and to modify the sub-components of the concept for this domain.
3. To propose a comprehensive measurement framework for the concept of VUSR in which all the measurement criteria, their indicators as well as the corresponding performance attributes have been outlined. The proposed framework needs to take into account different levels of the university's performance, including resources, input and activities.

4. To develop a holistic measurement tool and its corresponding methods to measure the VU's commitment to social responsibility. The holistic measurement tool needs to take into account not only the VU stakeholders' perceptions regarding the university's performance, but what VUs actually do to commit to social responsibility.
5. To capture the fuzzy nature of the concept while attempting to develop the measurement methodology. The computation of the concept needs to be equipped with fuzzy techniques for a more precise evaluation.
6. To validate the developed measurement methodology for the VUSR concept by engineering a prototype system and providing a knowledge-sharing portal to test the concept.

15.4. The Outcomes of this Thesis

The outcomes of the thesis can be summarised as follows:

(1) This thesis developed the formal definition of the CSR concept in the context of higher education based on the existing definitions throughout the literature, to overcome the variety of terms, definitions and interpretations in the literature. The notion of USR has been defined using each of the key dimensions and key concepts through a wide study of the literature and using a variety tools to justify the findings. Therefore, the research significance is underpinned by the development the world's first ontology of USR and VUSR.

(2) This thesis developed the USR and VUSR ontology dimensions in the context of VUs which is complete, new and represents the innovation of the thesis.

(3) The thesis proposed an assessment framework including modelling and mapping the online universities' commitment to VUSR along different dimensions.

(4) While most of contributions for measurement of the university's quality performance regarding social responsibility quantify the concept from a single-perspective view, this thesis proposed a multi-perspective view where the available data regarding the university's conduct in VUSR, as well as different stakeholders' perspectives, are considered. Therefore, the overall VUSR score represents the quality of a VU and helps online education providers, managers, the general public and other stakeholders to evaluate the quality of education, mapping their commitments to the social responsibility metrics, and allowing natural justice for any online education providers as well as online students and staff receiving and reviewing the quality and reputation of the online education.

(5) This research is the first of its type to make use of fuzzy logic to measure social responsibility in the online education setting. It is important to note the factors that comprise social responsibility are fuzzy in nature and can be best modeled and represented by making use of fuzzy logic. The proposed measurement scale for VUSR in this thesis takes advantage of fuzzy techniques to address the complexity of human judgment in the process of measurement.

(6) The outcome of this thesis is an online knowledge-sharing portal which allows all parties to share knowledge about the USR and VUSR, and its methods, techniques and measures can be used by any tool for assessing online universities. The proposed research not only impacts online universities, but also educational contexts more broadly and can be adapted to conventional universities' social responsibility measures.

(7) The outcome of this research can be used by online universities as a mechanism for developing quality, trust and reputation strategies. A given VU would be able to evaluate its overall VUSR score and identify the area(s) for improvement and to improve its VUSR score.

15.5. The Contributions of This Thesis

The major contribution of this thesis to the body of knowledge is that it proposes a holistic measurement framework and methodology which enables online universities to quantify their contribution to social responsibility. The developed methodology contains an ontology-based VUSR framework which rests on a comprehensive definition of the concept and its components in the context of the online university. The elements that form the core contribution of this thesis include:

1. The formal knowledge representation of the USR concept (i.e. the USR ontology), which represents the conceptual model of the main concept of this thesis.
2. The ontology-based VUSR representation which outlines the components and sub-components of the social responsibility concept in online universities.
3. The VUSR assessment framework comprising a comprehensive definition and detailed overview of the VUSR measurement criteria, indicators and their performance attributes.
4. The identified significance value of the measurement criteria determined through fuzzy techniques, capturing the fuzziness of the concept.
5. The fuzzy logic-based VUSR metrics comprising 15 different fuzzy scales which will be employed in the broad solution proposed by this thesis.
6. The VUSR portal which enables the online universities to take advantage of the proposed methodology through automated processes.

15.5.1. Contribution 1: The Formal Knowledge Representation of the USR Concept

Prior to developing the measurement approach for social responsibility of VUs, this concept needs to be comprehensively defined. However, the literature review revealed that the concept has not received enough attention in its totality. Therefore, the researcher attempted to configure the general understanding of the concept in the higher education setting. Consequently, the literature was searched to find how the concept of USR had been defined by academics and practitioners. The significant

finding in this initial stage was that a variety of terms have been used to refer to the domain of USR. 'University community engagement', 'scholarship of engagement', 'university civic engagement' are just some examples of these terms. Academics and practitioners in the higher education field used each term to define and highlight the responsibilities that a higher education institution should take to its community and society. However, in each term some aspects of the concept have been considered. There terms and the shortcomings involved with their definition were presented in section 2.2.

After compiling the existing definitions regarding how higher education institutions can contribute to social responsibility, the body of knowledge was analysed through content analyses software. The purpose was to extract the aggregated understandings of the concept from the literature. The first output of analyses was the identification of the main concepts by which USR has been defined. The extracted concepts and notions were investigated in the same body of knowledge to obtain the meaning of these notions in the context of USR and how they were related to each other. Finally, according to the analyses of the existing body of knowledge, the formal representation of the concept, i.e. USR ontology, was generated which provided the fundamental base for the VUSR definition. This ontology and its sub-components were outlined in Chapter 5 and Chapter 6.

This contribution was a milestone in the literature of social responsibility in the higher education setting where a variety of definitions for the concept using different terms were analysed to develop a universal understanding. To the best of the researcher's knowledge, this is the first attempt to analyse the variety of definitions of the concept from different perspectives to provide a formal representation of the USR concept.

15.5.2. Contribution 2: The Ontology Development for VUSR

The second important contribution of this thesis to the literature of online education is to develop an ontology for VUSR. As the formal representation of the USR concept outlined the social responsibility of universities in the general context of higher

education, it needed to be modified for application in VUs. Therefore, the main components of USR were investigated in the online education literature to find their definitions and associated concepts. In this regard, concept definition and related notions for education, research activities, service provision, community engagement and transparency were searched and the results presented in Chapter 7.

Based on the components' definitions and their associated terms in the literature, the ontology of VUSR was generated in three levels of concepts. This formal representation of the concept provided the outline for the VUSR measurement framework. According to this ontology, the concept of social responsibility for the online higher education setting was defined for the first time in the thesis. To the best of the researcher's knowledge, there is no other definition for the concept of VUSR in the literature covering all the aspects of the domain. The visual representation of the VUSR ontology is also unique. While there are contributions in which components of the VUSR, concept such as community engagement, quality of education, transparency, etc., have been defined, there are no contributions including all aspects and dimensions of the concept.

15.5.3. Contribution 3: The Ontology-based VUSR Measurement Framework

The third major contribution of this thesis to the literature is to develop the ontology-based VUSR measurement framework. The VUSR ontology was used to construct the hierarchy of the VUSR measurement criteria. Five major criteria alongside 22 sub-criteria were defined for this measurement framework, detailed in Chapter 8. In order to make the criteria and sub-criteria measureable, the performance attributes for each sub-criterion were extracted from the literature. A number of performance attributes were outlined for the VUSR measurement framework by which the VUs' commitment to social responsibility can be quantified. These attributes were presented in Chapter 9.

Although the existing literature contains a considerable amount of works that attempt to quantify the components of VUSR, to the best of the researcher's knowledge no contribution proposed a comprehensive measurement framework for

VUSR considering all its components. Approaches were proposed for measuring QOVE as one of the most important components of VUSR, however the literature does not provide a measurement framework for other aspects, such as ethical contribution in online teaching/learning or service provision, transparency, the online university's community engagement, etc. The measurement framework in this thesis was developed to include all these aspects, which may be a landmark for the literature of VUSR.

15.5.4. Contribution 4: Identification of Importance Values for the VUSR Criteria

The fourth major contribution of this thesis to the literature is to employ and examine different techniques to identify the significance value of each VUSR measurement criterion. As not all the measurement criteria have the same level of importance, it was crucial to identify this value for each of them. Consequently, the researcher proposed making use of AHP to determine the degree of importance of each measurement criterion. The co-occurrence frequency of each criterion in the analysed corpus of data was considered for a more realistic judgment in the AHP technique. Therefore, the initial judgments in this technique are supported by the literature, not the researcher's own preferences. The Expert Choice software was also employed to carry out sensitivity analyses and to prioritise the criteria accordingly. A simulation for measuring the VUSR concept, and comparing five VUs accordingly, was conducted. All details regarding the AHP approach are outlined in Chapter 10.

In order to consider the fuzzy nature of the VUSR measurement criteria, in this research, a fuzzy AHP was also employed to determine the importance value of the measurement criteria. Also, to ascertain the value considering the interrelationships between the criteria, another fuzzy ANP was employed. All the details about these fuzzy techniques and their application for prioritising the measurement criteria were discussed in Chapter 11.

To the best of the researcher's knowledge, there was no proposed approach in the literature to determine the significance value for the VUSR measurement criteria. There is the AHP approach for measurement purposes in the higher education context,

but for measuring VUSR and determining the significance value of its criteria, this is the first contribution. Another important aspect of this contribution is that the basis for judgment is the corpus of data, which is extracted from 168 scholarly published works. While, in the literature the identification of the significance value of the measurement criteria is common, researchers rely on the judgments made by a very small number of experts in the field.

15.5.5. Contribution 5: The Fuzzy Logic-based VUSR Metrics

The next major contribution of this thesis to the existing literature is to propose a fuzzy logic-based VUSR metrics for quantification of the concept. As the nature of the social responsibility concept involves vagueness and fuzziness, its measurement approach needs to be equipped with fuzzy techniques to address this feature. Therefore, in this thesis a fuzzy logic-based metrics comprising a number of measurement scales customised for quantification of the variables in the VUSR measurement framework was proposed.

The measurement scales were proposed in two groups, linguistic and numerical scales, besides their corresponding fuzzy triangular scales. To the best of the researcher's knowledge, this thesis is the first of this type to present a comprehensive fuzzy logic-based metrics that proposes a variety of measurement scales for measuring the VUSR through its components. In the literature, there are very few approaches taking advantage of fuzzy logic for measuring the concept of social responsibility, but no approach was found using such techniques for VUSR. Besides, the proposed metrics in this thesis is comprehensive and unique.

15.5.6. Contribution 6: The VUSR Metrics Portal

The sixth major contribution of this thesis is to develop the VUSR portal which can be used by online universities not only to measure their commitment to social responsibility, but also to take advantage of the knowledge-sharing portal features. The researcher attempted to include all created knowledge and the proposed framework and methodology into a web-based portal. The major part of the portal is

an automated tool for measuring the concept of social responsibility of VUs. The university managers employ the VUSR metrics portal to enable different stakeholders to engage in the measurement process by providing their points of view by answering a set of questions. The portal analyses the input and displays the VUSR score in numerical and visual formats to the users.

Another major component of the VUSR portal is the knowledge-sharing portal where users can have access to the formal representation of VUSR knowledge that has been created in this thesis. The VUSR ontology is accessible in human and machine languages. In this portal, the weblog is another component where different university stakeholders and domain experts can share their ideas and participate interactively to further knowledge in this field.

To the best of the researcher's knowledge, the VUSR portal is a unique contribution and the first one that facilitates the VUSR measurement in an automated manner, while taking advantage of the proposed measurement framework and methodology and enabling knowledge sharing around the VUSR domain.

15.6. Future Works

The proposed VUSR measurement methodology in this thesis is the first of its type by which VUs will be able to quantify their contribution to social responsibility in a reciprocal dialogue; however, there are a number of improvements that could be undertaken in future work. This section of the chapter discusses the future works that could strengthen the developed measurement methodology for the online university social responsibility concept.

15.6.1. Future Work on VUSR Ontology Improvement

In this thesis, the sources of knowledge used for the ontology development were extracted from scholarly published works to 2012 when the analyses were undertaken. Further works could consider VUSR ontology evolution. For example, the knowledge-

sharing portal could be used to obtain the perspectives of different stakeholders regarding the concept definition instead of just scholars' perspectives. This can be achievable through one of the major components of the Hozo tool i.e. ontology manager. In this environment, different users can have work together and improve the existing ontology collaboratively through the internet. Therefore, the engineered ontology may be further extended to capture missing or new conceptualisations that may arrive with time.

15.6.2. Application of the Developed VUSR Metrics to the Real World

The researcher intends to convert the VUSR metrics prototype system created in this thesis into a commercial system that can be applied to real-world online universities. As mentioned in the previous chapter, the developed prototype system was implemented by a very small sample just to provide proof of the concept and to verify the methodology. Further, improvements to the engineered system will be possible if it is implemented in the real world to a wider range of users and to different VUs.

15.6.3. Application of the Developed Methodology for Ranking VUs Based on Their Commitment to Social Responsibility

Although university ranking was not in the scope of this research, the researcher believes that the developed VUSR measurement framework and methodology with some extensions could be employed to rank online universities based on their commitment to social responsibility. In order to make the approach applicable for ranking VUs, the system needs to focus on the common mission of these higher education systems and take advantage of online education experts in ascertaining the proposed significance values.

15.6.4. Application of the Developed Methodology in Conventional Universities

For future work, the researcher suggests that a measurement framework and its prototype system could be developed based on the USR ontology presented in Chapter 5, but following guidelines provided for VUSR metrics. In fact, much effort has been

made, and quite some effort is required to develop the metrics and portal which can be implemented to measure social responsibility in conventional universities.

15.6.5. Development of Practical Guidelines for Social Responsibility Implementation

Despite the existing debate concerning social responsibility and its link with higher education strategy, practical guidelines for social responsibility implementation in educational institutions remain unclear. In future works, researchers need to focus on this aspect of the domain, which seems to be untouched in both conventional and virtual higher education contexts.

15.7. Conclusion

In this chapter, the researcher recapitulated the work that has been undertaken and documented to address the identified research issues in this thesis. The chapter presented the contributions that were made to the existing literature through this research. A brief description regarding future work that can be undertaken for the improvement of the developed VUSR ontology and its measurement framework and methodology were provided. The researcher does not believe in taking a one-size-fits-all approach, however a VUSR metrics that is applicable for all online universities, with some modifications based on the university's structure and policies, is proposed.

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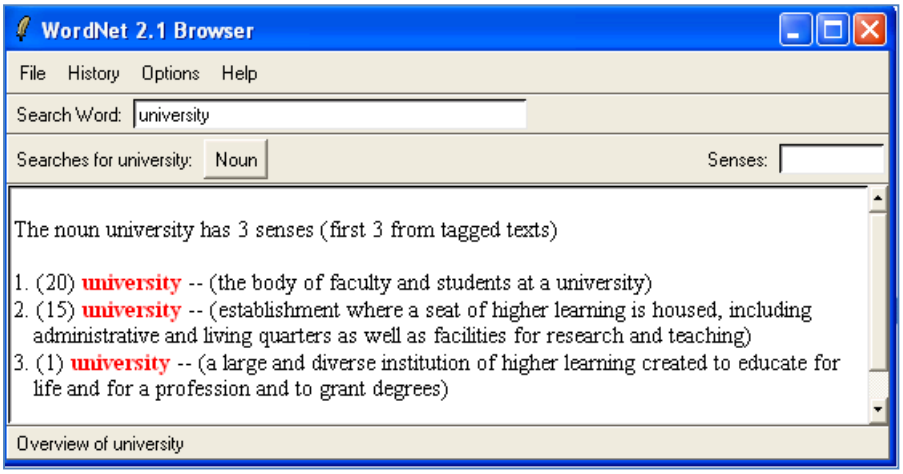
Appendix A

Relationships between USR and its concept through the literature according to the Leximancer query results:

USR

- USR is an ethical approach.
- USR is the need to strengthen civic commitment.
- USR is active citizenship.
- USR is encouraging the students to provide social services.
- USR is encouraging the academic staffs to provide social services.
- USR is promoting environmental commitment to sustainable development.
- USR is commitment for local sustainable development.
- USR is commitment for global sustainable development.
- USR is providing social services to local community.
- USR is developing a sense of civil citizenship.
- USR begins by educating the primary stakeholders.
- USR is about volunteering.



Figur1. Different sense of the word of University

Relationships between University and other concepts of USR through the literature according to the Leximancer query results:

University

- University has **local community**.
- University has **global community**.
- University is responsible to the **communities**.
    - ✓ University is responsible to its **global** community.
        - ➢ University should improve the quality of life of its global community.
    - ✓ University is responsible to its **local** community.
    - ✓ University **provides services** to its local community.
        - ➢ University should improve the quality of life of the communities.
        - ➢ University transfers knowledge to communities.
        - ➢ University imparts education to communities.
            - ▪ University should make education more relevant.
        - ➢ University should manage educational impacts.
        - ➢ University education should improve employability.
    - ✓ University should **address local needs**.
    - ✓ University should improve **social services**.
        - ➢ University should address social issues.
        - ➢ University should commit to social equity.
        - ➢ University should promote social development.
        - ➢ University should develop social engagement.
        - ➢ University should assess its engagement.

- University is responsibility to its **students**.
    - ✓ University **educates** students.
        - ➢ University should develop socially responsible of students.
        - ➢ University should change student's attitudes.

    - ✓ University is responsible about **access** to education.
        - ➢ University should provide alternative access pathways.
        - ➢ University develops access programs.

    - ✓ University transfers **knowledge** to students.
    - ✓ University imparts **learning**.
        - ➢ University should provide lifelong learning.

    - ✓ University imparts **teaching**.
        - ➢ University is responsible to impart effective teaching.
        - ➢ University should contribute to high quality teaching.
        - ➢ University provides professionals in teaching.
        - ➢ University should link teaching to social participation.

    - ✓ University should **recruit** local students.
    - ✓ University should encourage '**social service**' by students.
    - ✓ University should improve the **quality of life** of its students.
    - ✓ University should make available **resources**.

- University is responsibility to the **society**.
    - ✓ University emerges societies.
    - ✓ University impacts on society.
        - ➢ University should improve the quality of life of its society.
        - ➢ University should promote development.
        - ➢ University develops civil society.

    - ✓ University provides **services** for society.
        - ➢ University carry out scientific **research**.
            - ▪ University should enrich research activities.
            - ▪ University should link research to social participation.
        - ➢ University transfers **knowledge** to society in general.
        - ➢ University imparts **teaching**.
            - ▪ University is responsible to impart effective teaching.
            - ▪ University should contribute to high quality teaching.
            - ▪ University provides professionals in teaching.
            - ▪ University should link teaching to social participation.

- University should address **societal issues**.
- University should be accommodated to **society demands**.

✓ University should foster **citizenship**.
- University should strengthen active citizenship.
- University should develop civic citizenship.

✓ University contributes to the **public good**.
✓ University is responsible to act as a **good corporate citizen**.
✓ University should **address local needs**.
✓ University is responsible to **meet the needs**.
✓ University should make available **resources**.

- University initiates **activities** in line with its core values.
  - ✓ University should enrich scholarship activities.
  - ✓ University should enrich creative activities.

- University provide **services**.
  - ✓ University provides **public** service.
  - ✓ University should **assess** its public services.
  - ✓ University should develop new ways of educational services **delivery**.
  - ✓ University is promoting service based learning programs.

- University has an **economic** responsibility.
  - ✓ University emerges economies.
  - ✓ University should increase economic opportunities.
  - ✓ University should promote economic development.

- University is responsible to **businesses**.
- University must initiate the **changes**.
- University has **environmental** responsibilities.
  - ✓ University is responsible to manage environmental impacts.
  - ✓ University is responsible to improve environmental awareness.
  - ✓ University is responsible to promote environmental sustainability.

- University represents the centre of **knowledge**.
  - ✓ University generates knowledge.
  - ✓ University transfers knowledge to communities.
  - ✓ University preserves the achieved knowledge.
  - ✓ University extends the achieved knowledge.

- University is responsible to the **government**.

- University is responsible to its **stakeholders**.
    - ✓ University should serve its stakeholders.
        - ➢ University should improve the quality of life of its stakeholders.

- University has **ethical** responsibilities.
    - ✓ University should discus **ethical problems**.
    - ✓ University should provide **values**.

- University has a **civic role**.
    - ✓ University works on civic engagement programs.
    - ✓ University should strengthen civic responsibility.
    - ✓
- University is responsible to **groups**.
    - ✓ University should identify partner groups.
    - ✓ University should nurture partner groups.
    - ✓ University should empower groups.

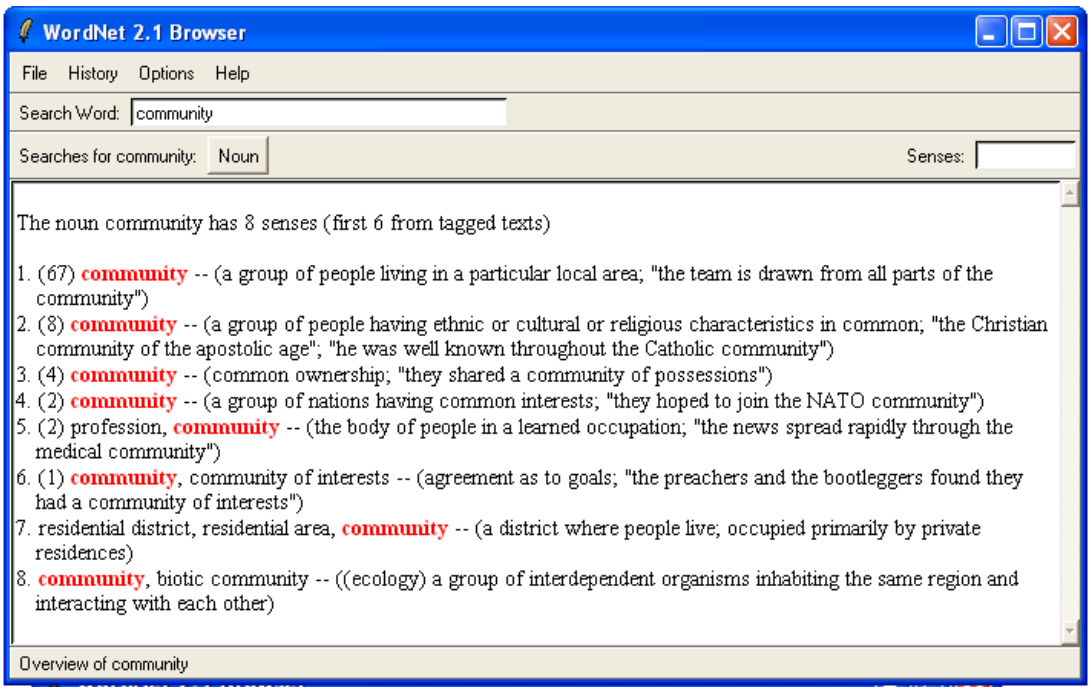
- University is responsible to **citizens**.
    - ✓ University is responsible to serve citizens.
    - ✓ University is responsible to prepare citizens.
        - ➢ University is responsible to educate citizens.
        - ➢ University is responsible to produce active citizens.

- University is responsible to **individuals**.
    - ✓ University should **empower** individuals.
        - ➢ University **educates** individuals.
        - ➢ University should improve the **quality of life** of its local community.

- University is responsible about **resources**.
    - ✓ University is responsible regarding resource **management**.
    - ✓ University should **make available** resources.

- University is responsible to its **staff (faculties)**.
    - ✓ University should improve the **quality of life** of its staff.
    - ✓ Universities should encourage '**social service**' by staff.
    - ✓ University should improve social responsibility of its staff.

Community

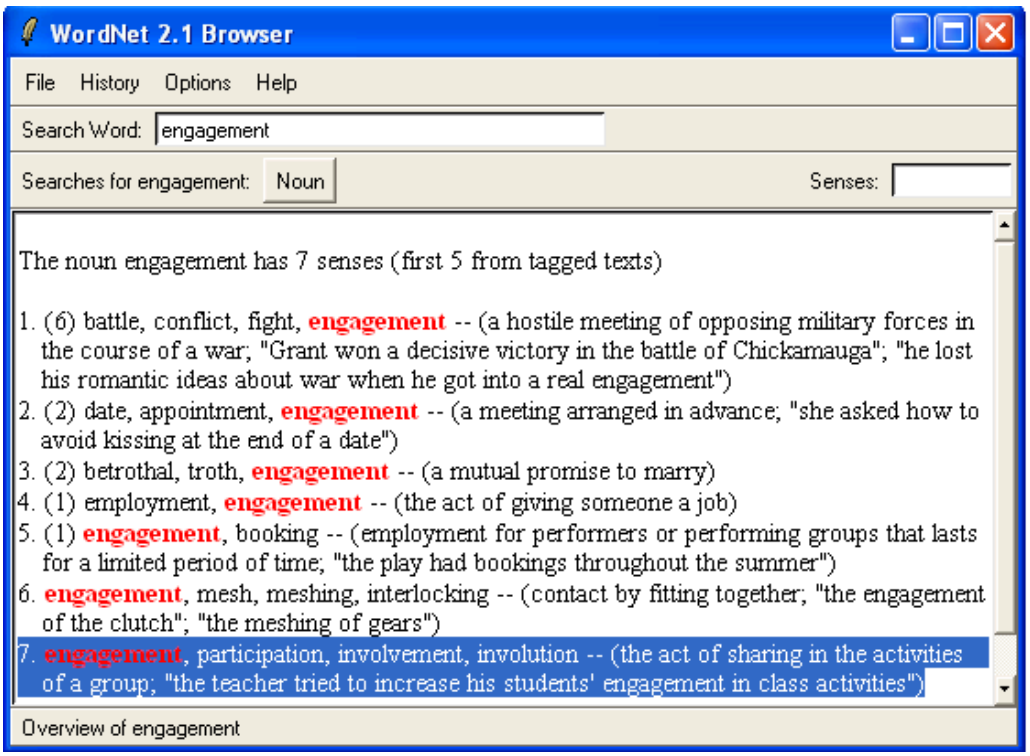


Figur2. Different sense of the word of community

Relationships between Community and other concepts of USR through the literature according to the Leximancer query results:

- Community is linked to education.
- Community is regarded as a strategy of government intervention.
- Community ideologically mobilizes shared values.
- Communities of university include businesses.
- Communities of university include industries.
- Communities of university include schools.
- Communities of university include colleges.
- Communities of university include students.
- Communities of university include students' families.
- Communities of university include staffs.
- Communities of university include staffs' families.
- Communities of university include university partners.
- Communities of university include citizens.
- Communities of university include K-12 education.
- Communities of university include groups of local citizens.
- Community resources include colleges and universities.
- Communities of university include global communities.
- Communities of university include local communities.
- Community can be a synonym for society at large.

Engagement

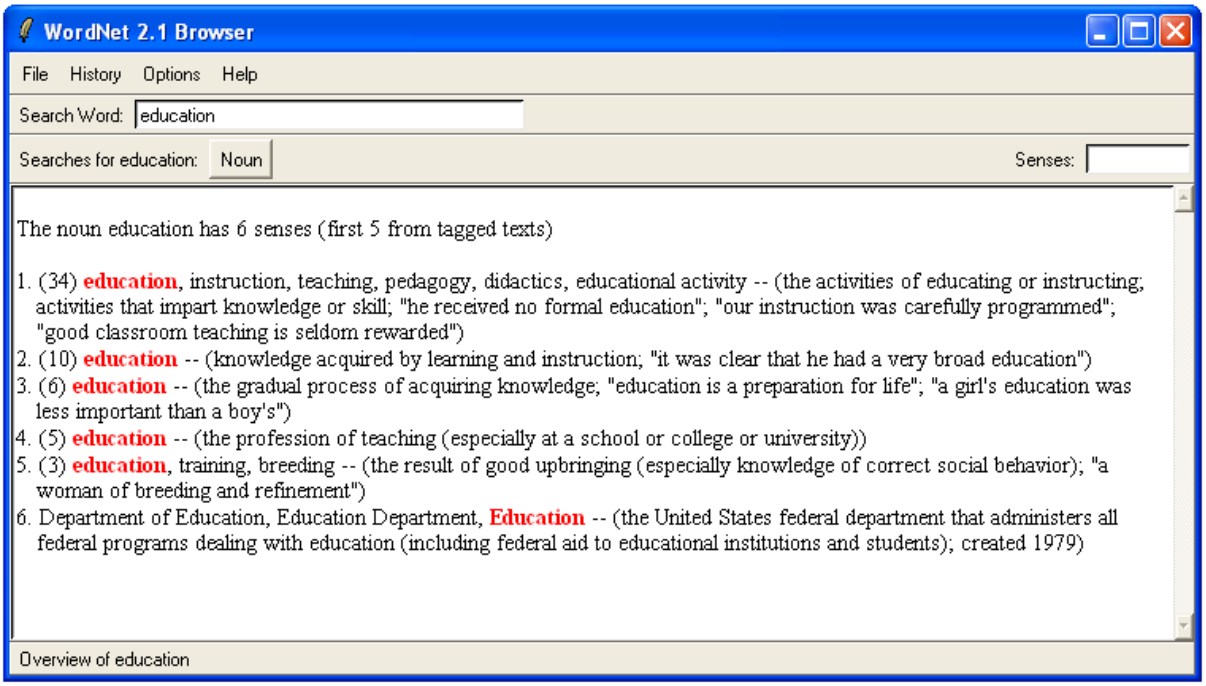


Figur3. Different sense of the word of Engagement

Relationships between Engagement and other concepts of USR through the literature according to the Leximancer query results:

- Engagement describes collaboration between university and community.
- Engagement describes relationships between university and community.
- Engagement is a scholarly activity.
- Engagement is partnership of university with public sector.
- Engagement is partnership of university with private sector.
- Engagement seems to be providing services to society.
- Engagement can be seen as a vehicle for political literacy.
- Engagement can be seen as a vehicle for social justice.
- Engagement can be seen as a strategy for universities feed.
- Engagement implies thoughtful interaction with non-university world.
- Engagement should foster citizenship.
- Engagement should address local issues.
- Engagement should mobilize university resources.
- Engagement should enrich research.
- Engagement should enrich creative activities.
- Engagement should enrich teaching.
- Engagement should enrich learning.

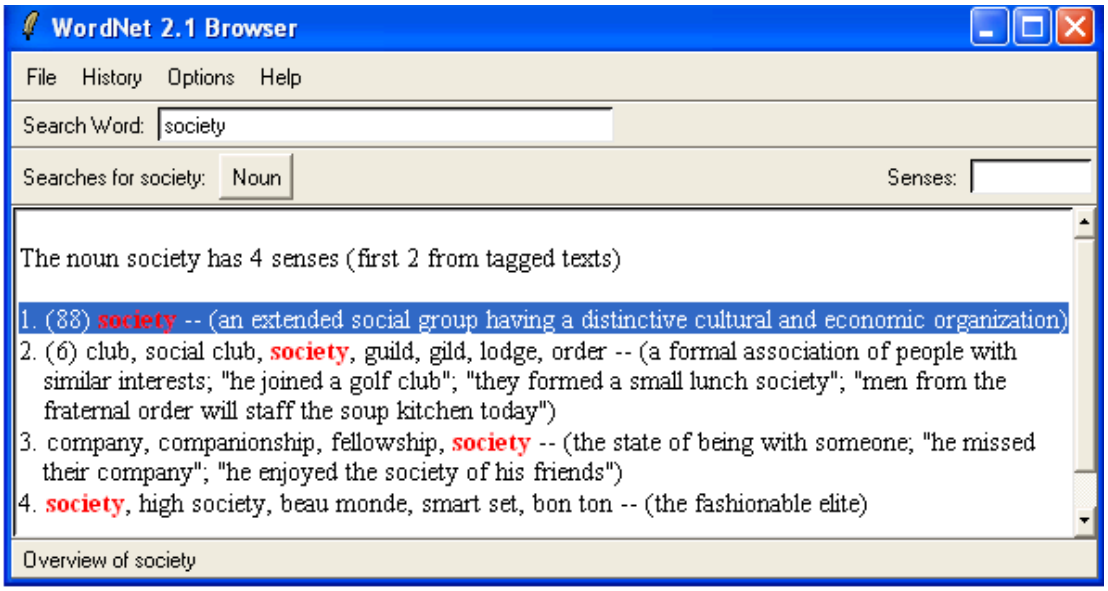
Education



Figur4. Different sense of the word of Education

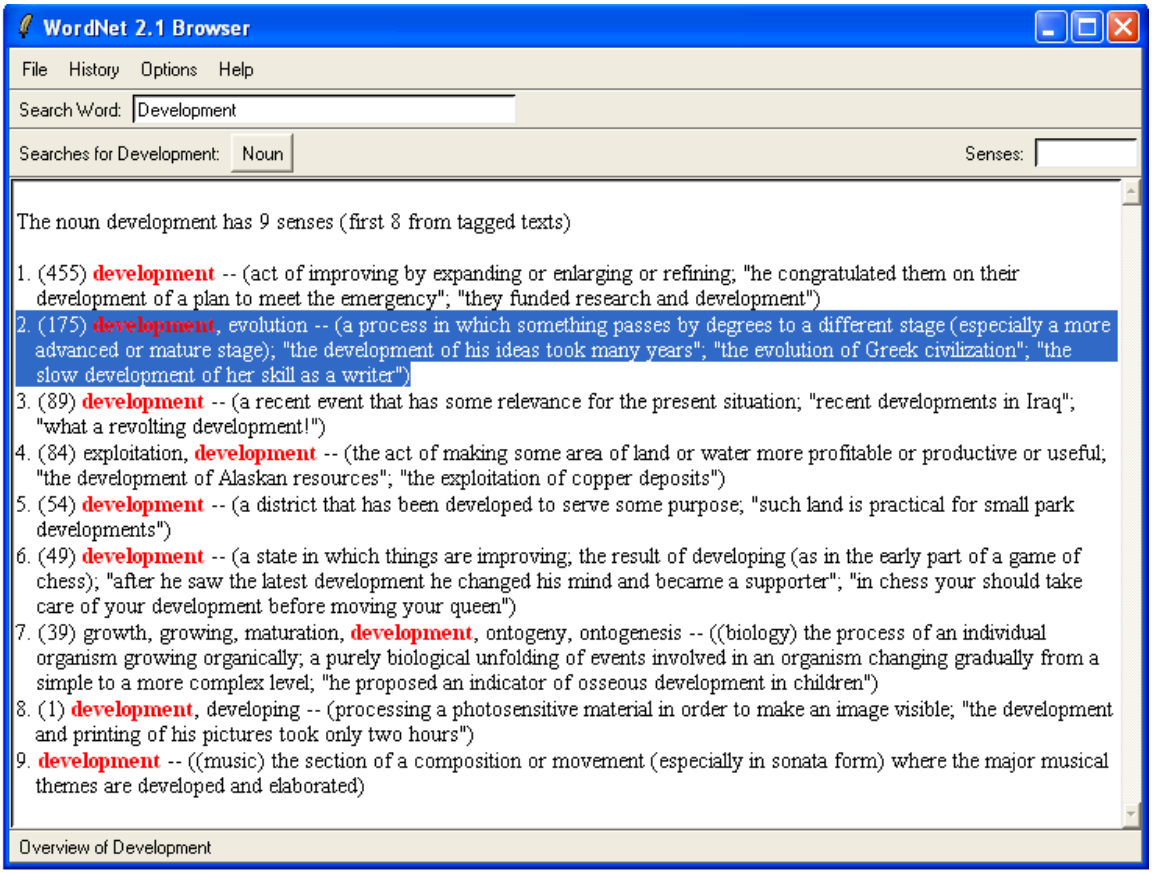
Relationships between Education and other concepts of USR through the literature according to the Leximancer query results:

- Education results in community change.
- Education should be according economic objectives.
- Education should be according social objectives.
- Education can provide benefits to public.
- Online education increases educational access for underserved populations.
- Online education offers a viable strategy for social responsibility.
- Higher education should be restructured to develop social responsibility.



Figur5. Different sense of the word of Society

Relationships between Society and other concepts of USR through the literature according to the Leximancer query results:



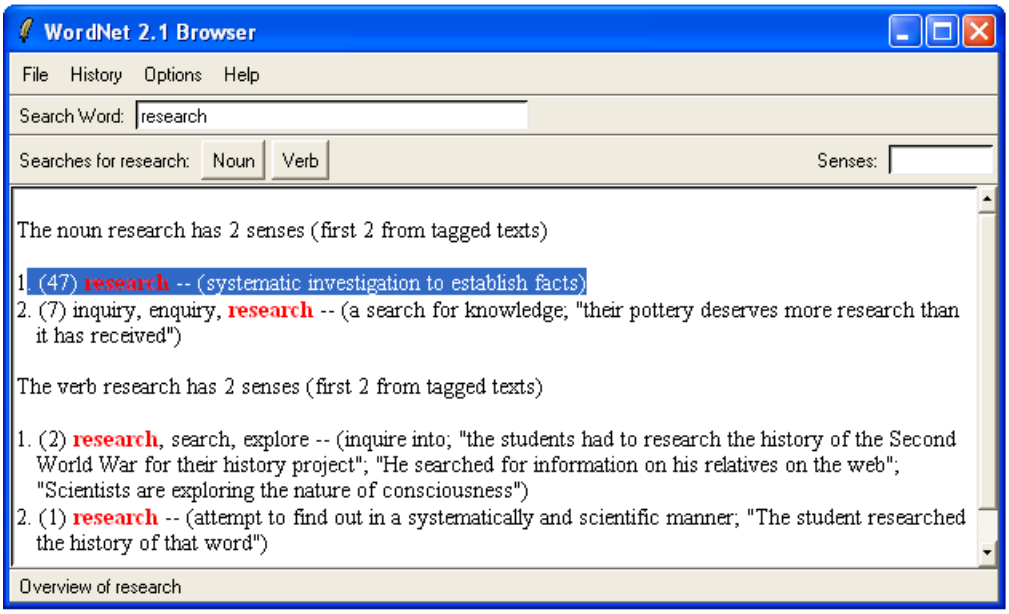
Figur6. Different sense of the word of Development

Relationships between Development and other concepts of USR through the literature according to the Leximancer query results:

Development

- Development is influenced by political changes.
- Development is influenced by technological changes.
- Development is influenced by economical changes.
- Development is influenced by environmental changes.
- Development is influenced by social changes.
- Development is promoted by university.

Research

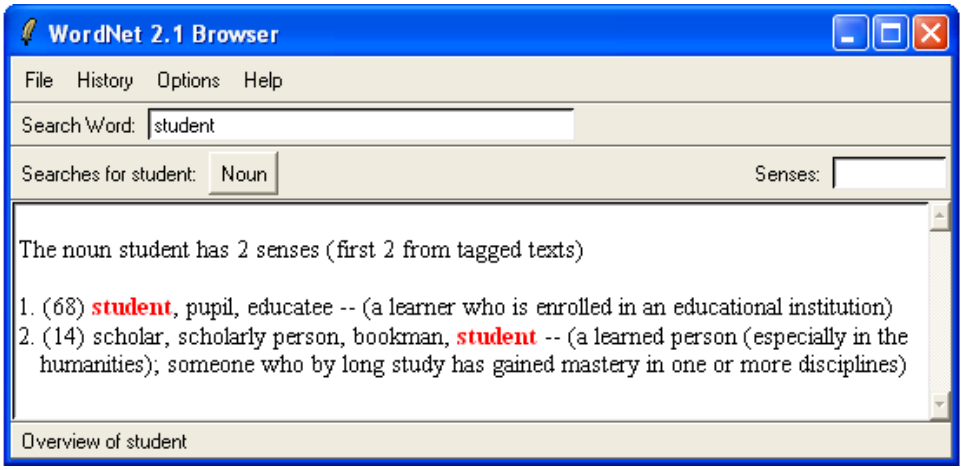


Figur7. Different sense of the word of Research

Relationships between Research and other concepts of USR through the literature according to the Leximancer query results:

- Research is university's mission.
- Research should address areas of local needs.
- Research should be according economic objectives.
- Research should be according social objectives.
- Research can provide benefits to public.
-

Students

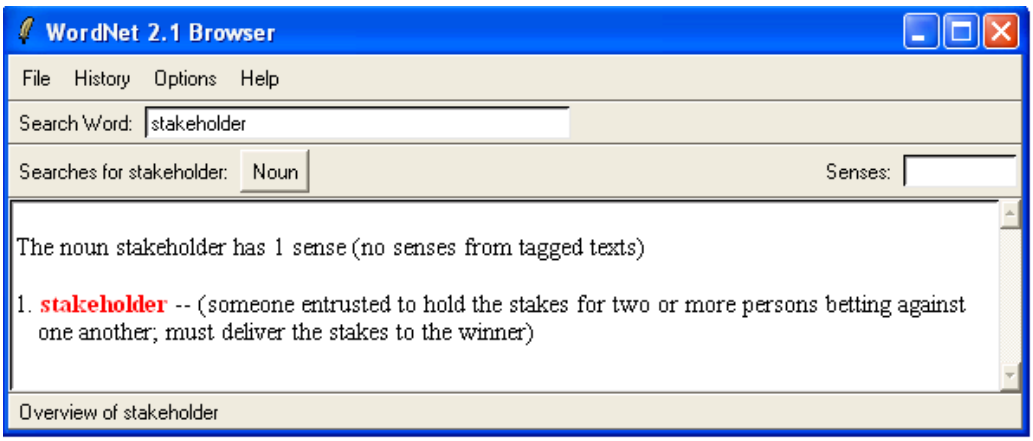


Figur8. Different sense of the word of Students

Relationships between Students and other concepts of USR through the literature according to the Leximancer query results:

- Students are the key members of academic community.
- Student is one of the primary stakeholders of university.
- Student's first teacher is his family.

Stakeholders



Figur9. Different sense of the word of Stakeholder

Relationships between Stakeholder and other concepts of USR through the literature according to the Leximancer query results:

- Stakeholders include students.
- Stakeholders include staffs.
- Stakeholders include academic faculty.
- Stakeholders include Ministry of Education.
- Stakeholders include government bodies.
- Stakeholders include local government body.
- Stakeholders include businesses.
- Stakeholders include other educational institutions.
- Stakeholders include public.

- University has responsibilities.
- University educates responsibilities.
- University promotes responsibilities.
- University teaches social responsibilities.
- University works on social responsibility programs.
-
- University should embed public responsibility.
-
- University has stakeholders.
- University stakeholders are students.
- University stakeholders are faculties.
- University stakeholders are employees.
-
- University reflects the values.
- University should strengthen values.
- University needs to be re-grounded on its original values.
- University initiate activities in line with its core values.
-
- University has global community.
-
- University has missions.
- University has social missions.
- University economical missions.
-
- University is responsible regarding resource management.
-
- University should improve the quality of life of its faculty.
- University is responsible to its faculty.

Change

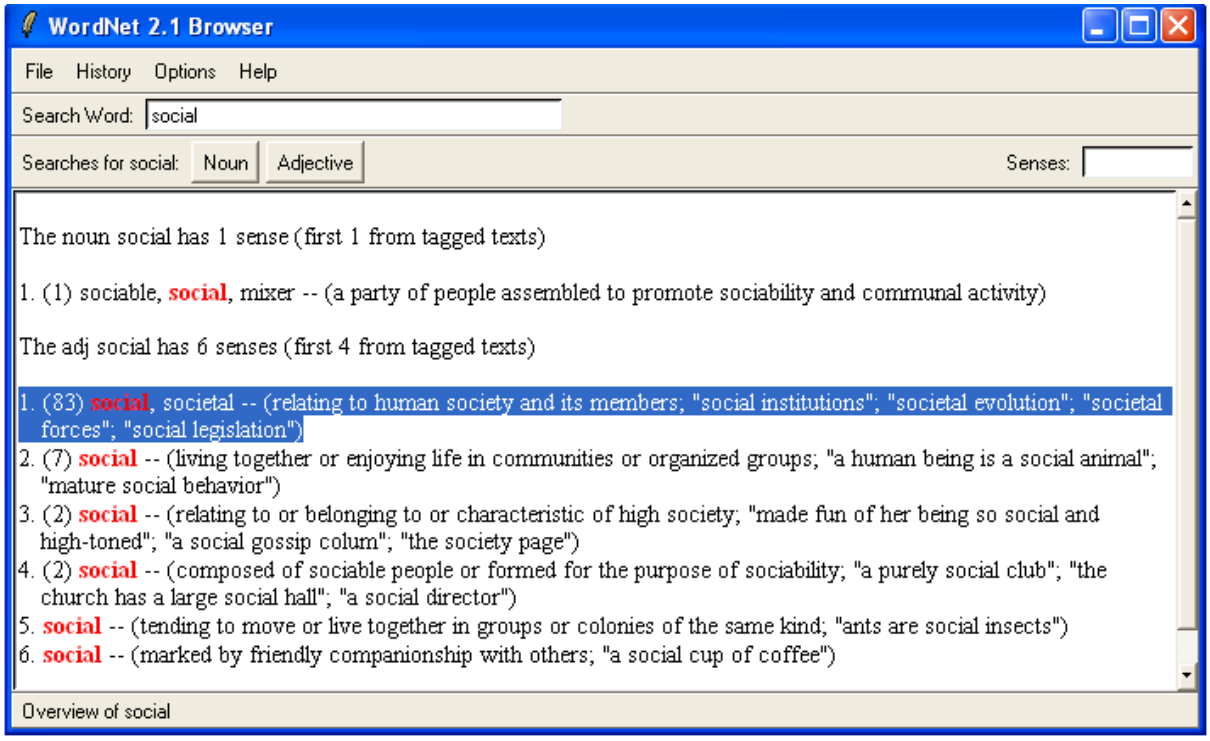
- Changes must first be made in university governance.
- Changes must first be made in university management.

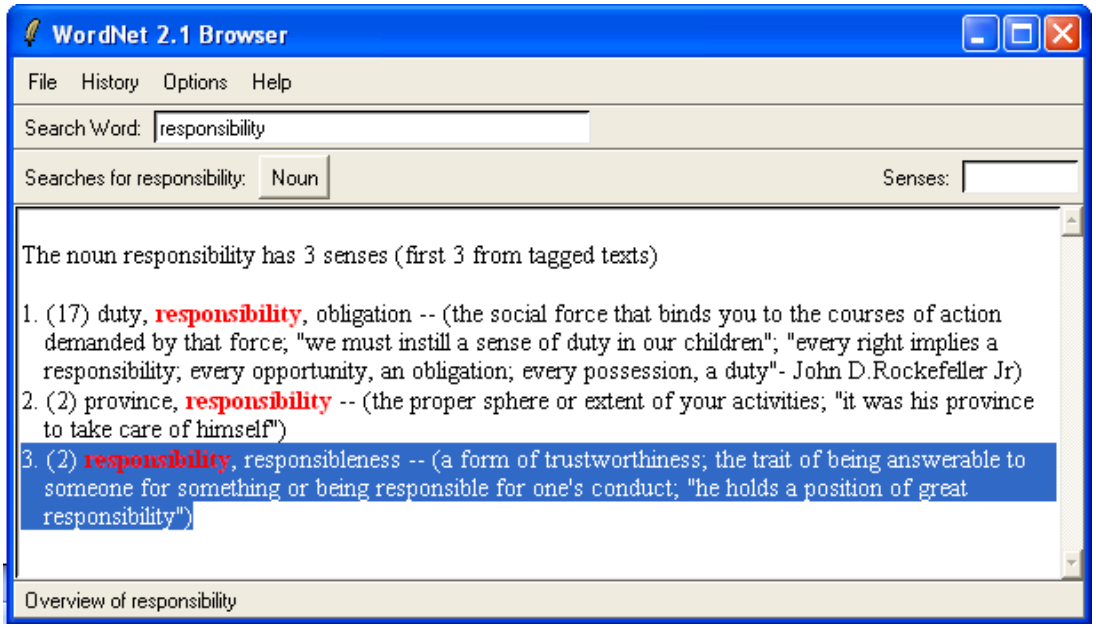
Staff

- Academic staffs are the primary stakeholders of university.
-

Knowledge

- Knowledge is disseminated through student learning.





Appendix B

USR Components according most frequent notions across the literature

USR Components	hted Perce	Importance
Stakeholders	9.96	**50.03%**
Engagement	2.77	**13.91%**
Education	1.35	**6.78%**
Research	1.32	**6.63%**
Scholarship	1.32	**6.63%**
Learning	1.16	**5.83%**
Service	1	**5.02%**
Teaching	0.55	**2.76%**
Economic	0.27	**1.36%**
Ethics	0.21	**1.05%**
Total	19.91	**100.00%**

The importance of USR Components exclude "Stakeholders"

USR Components	hted Perce	Importance
Engagement	2.77	**27.84%**
Education	1.35	**13.57%**
Research	1.32	**13.27%**
Scholarship	1.32	**13.27%**
Learning	1.16	**11.66%**
Service	1	**10.05%**
Teaching	0.55	**5.53%**
Economic	0.27	**2.71%**
Ethics	0.21	**2.11%**
Total	9.95	**100.00%**

USR Components exclude "Stakeholders" and "Engagement"

USR Components	hted Perce	Importance
Education	1.35	**18.80%**
Research	1.32	**18.38%**
Scholarship	1.32	**18.38%**
Learning	1.16	**16.16%**
Service	1	**13.93%**
Teaching	0.55	**7.66%**
Economic	0.27	**3.76%**
Ethics	0.21	**2.92%**
Total	7.18	**100.00%**

Appendix C

VUSR Ontology in XML version

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